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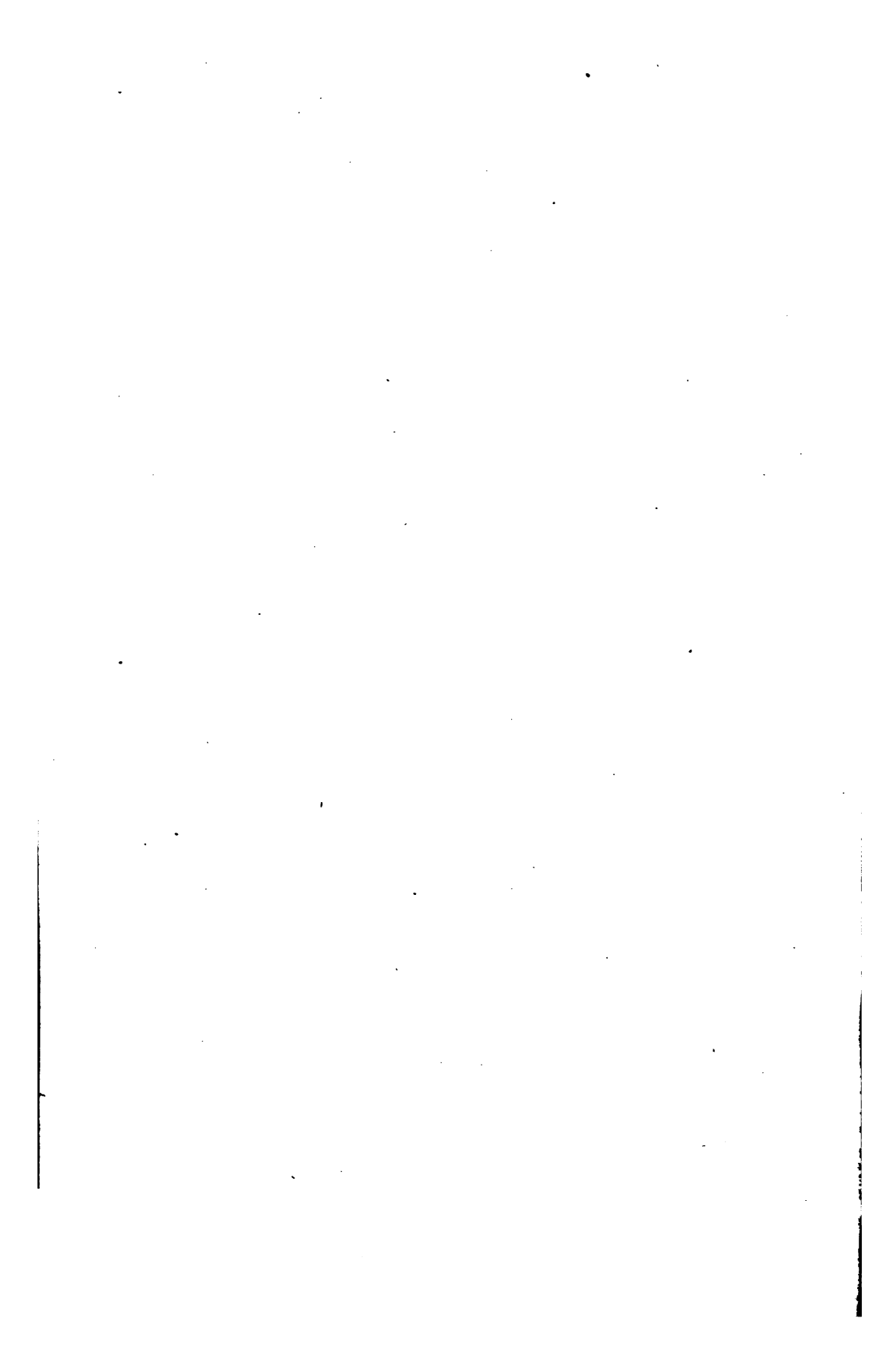
UNITED STATES GOVERNMENT

THROUGH

The Hydrographic Office.

6 Dec., 1894.









0. *Hydrog. office.*

No. 108—Part I.



U. S.-HYDROGRAPHIC OFFICE.

SAILING DIRECTIONS

FOR

LAKE SUPERIOR, ST. MARYS RIVER,

AND

STRAITS OF MACKINAC.

WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1894.

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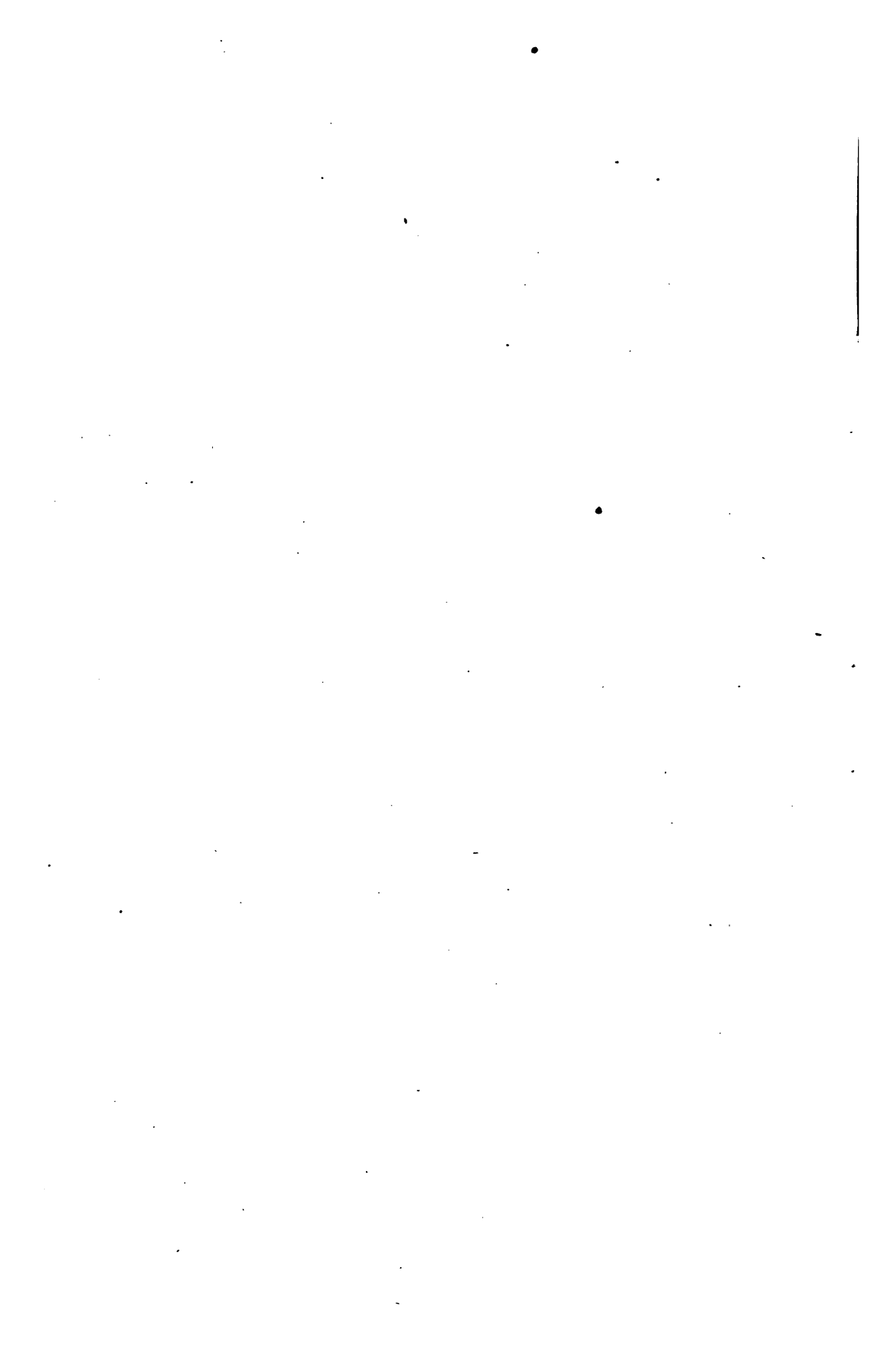
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The Agency, C. L. Co.

CONTENTS.

	Page.
Preface	V
Note	VII
List of charts	VIII
Index	97
List of Hydrographic Office publications	107
List of Hydrographic Office agents	118
CHARTS.	
Eagle harbor	19
Grand Marais, Mich	26
Grand Marais, Minn	29
Hay Lake Channel, St. Marys River	50
Current chart, Lake Superior	81
CHAPTER I.	
Lake Superior, general description and south shore	1
CHAPTER II.	
Lake Superior, general description, north shore, and the islands of Lake Superior	28
CHAPTER III.	
St. Marys River and Detour Passage	87
CHAPTER IV.	
Straits of Mackinac	54
CHAPTER V.	
Rules of the road for harbors, lakes, and inland waters of the United States	66
CHAPTER VI.	
Storm and weather signals, United States and Canadian	76
CHAPTER VII.	
Brief rules for the use of oil	78
CHAPTER VIII.	
Anchoring and riding out gales in deep water	79
CHAPTER IX.	
Currents	81
CHAPTER X.	
General information	88



PREFACE.

It is the intention of the Hydrographic Office to publish, as soon as possible, a complete set of sailing directions for the Great Lakes.

At present the sailing directions will be published in parts, beginning with the present work.

This will be followed in turn by Lake Michigan, Lake Huron with the St. Clair and Detroit rivers, and Lake St. Clair ; and finally by lakes Erie and Ontario, with the St. Lawrence River to Montreal.

At Montreal this work will connect with Hydrographic Office publication No. 100, thus giving complete sailing directions from Duluth, Minn., to the Atlantic Ocean.

The amount of available information in regard to Lake Superior is very limited ; the descriptions of the lake itself and the harbors on the United States side having been obtained principally from the annual reports of the Chief of Engineers, U. S. Army, and from the charts published by the United States Engineers.

The lake shore and harbors on the Canadian side are described from reports of the Canadian department of marine and fisheries.

The lighthouses, lightvessels, ranges, beacons, buoys, and daymarks, from the publications of the U. S. Lighthouse Board and the department of marine and fisheries of Canada.

It must be remembered that the first issue of such a work can not be perfect, and the Office must depend upon the kind assistance of those who dwell near the lakes as well as of those who navigate them, for prompt information concerning any errors or omissions, and such assistance is earnestly requested.

The articles appended to this work are such as may be of interest and value to the mariner.

“The Rules of the Road for the Lakes, etc., of the United States.”

“Signals: Weather, Storm, and Temperature, with Diagrams, United States and Canada.”

“Brief Rules for the Use of Oil,” with diagrams.

“Anchoring and Riding out Gales in Deep Water.”

“Currents of Lake Superior, with map,” United States Weather Bureau.

“Miscellaneous Matter.”

The thanks of the Office are due, for valuable information furnished in response to its circular letter, to—

Frank E. Wyman, Esq., the secretary of the Duluth Board of Trade ;

B. B. Inman, Esq., the manager of the Inman Line tugs and fire boats, Duluth, Minn. ;

C. F. Johnson, Esq., the collector of customs, Duluth, Minn. ;

A. M. Wiley, Esq., the U. S. Consular Agent, Port Arthur, Canada ;

Charles McCall, Esq., the U. S. Commercial Agent, Sault Ste. Marie, Canada, and

John Easby, Esq., the president of the village of Mackinac, Mich.

This work has been prepared by Lieut. D. H. Mahan, U. S. Navy, assisted by Mr. R. C. Ray, U. S. Navy.

The charts and illustrations were prepared by Mr. G. W. Littlehales, in charge of the Division of Chart Construction of this Office, and printed under his direction.

C. D. SIGSBEE,
Commander, U. S. Navy, Hydrographer.

U. S. HYDROGRAPHIC OFFICE,
WASHINGTON, D. C., *October 1, 1894.*

NOTE.

The bearings, courses, and trend of the land are true, and given in points and degrees.

The directions of the winds, the points from which they blow; the directions of the currents, the points toward which they set.

Distances are expressed in nautical miles (the corresponding statute miles follow in parenthesis).

It is well to remember that on Hydrographic Office charts bearings and courses are *true*; distances are given in *nautical* miles.

On U. S. Engineer charts bearings and courses are *true*; distances are given in *statute* miles.

On British Admiralty charts bearings and courses are *magnetic*; distances are given in *nautical* miles.

U. S. Engineers' charts to be used in connection with these sailing directions.

LAKE SUPERIOR.

- No. 36. Lake Superior No. 3.
- No. 32. Lake Superior No. 2.
- No. 31. Lake Superior No. 1.
- No. 25. West end of Lake Superior.
- No. 38. Isle Royale.
- No. 17. Ontonagon Harbor.
- No. 16. Eagle River.
- No. 11. Eagle Harbor.
- No. 12. Agate Harbor.
- No. 28. Copper Harbor.
- No. 30. Portage Lake and River.
- No. 29. L'Anse and Keweenaw Bay.
- No. 34. Huron Island.
- No. 24. Grand Island.

RIVER SAINT MARIE.

- No. 13. River Saint Marie No. 1.
- No. 14. River Saint Marie No. 2.
- No. 5. East Neebish Rapids.

STRAITS OF MACKINAC.

- No. 4. Straits of Mackinac.

LAKE HURON.

- No. 22. Lake Huron.

The following British Admiralty charts also cover the coasts described :

- No. 320. Lake Superior.

(Plans, Superior Bay, Rock, Marquette, Ontonagon, Eagle, Agate, and Copper Harbors.)

- No. 321. Grand Portage Bay to Hawks Islet, including Isle Royale.
- No. 322. Nipigon and Black bays.
- No. 323. Small Lake Harbor to Peninsula Harbor.
- No. 325. River St. Mary from Mud Lake to East Neebish.

(Plan, East Neebish Rapids.)

- No. 334. Mackinac Strait.
- No. 328. Port Collier.

CHAPTER I.

LAKE SUPERIOR AND GENERAL DESCRIPTION OF THE SOUTH SHORE.

LAKE SUPERIOR.

On a map published by the Jesuits in 1771, this lake was called "Lac Tracy, or Superieur," but it was visited by Père Mesnard as early as 1660.

Lake Superior is almost everywhere noble, grand, impressive, majestic, and was called by Crowfoot, a Blackfoot chief, "The Brother to the Sea."

The ascent from the ocean to Lake Superior does not average more than 6 inches to the mile, and even this ascent is not markedly noticeable till we proceed westward.

It is the largest known lake in the world, the U. S. Geological Survey giving it an area of 31,200 square miles, its length 412 miles, maximum breadth 167 miles, maximum depth 1,008 feet, and its height above the sea level 602 feet; but depths have been found as great as 1,386 feet. Its shore line is about 1,500 miles in length. It receives the waters of 200 rivers and drains a territory of 53,000 square miles. It practically belongs to the United States, although Canada owns the north shore it owns but little of the lake itself.

HARBORS OF REFUGE.

Grand Marais, Minnesota, is the only harbor of refuge on the north shore of the lake between Agate Bay (Two Harbors) and the International boundary line.

Eagle Harbor, Michigan, and Grand Marais Harbor, Michigan, both on the south shore, have been improved so as to make them harbors of refuge.

NAVIGATION.

As a rule, navigation opens in the middle of April, and closes the middle of December.

The two great evils to navigation are fogs and snow.

There are no tides and but light currents for the master to contend with on the lakes, and as these are the most uncertain of all elements for the navigator to calculate and allow for, it reduces very much the per cent of

danger in lake navigation, hence, the safe navigation of the lakes is confined to a correct compass, with a knowledge and frequent use on the part of the master of the azimuth tables; the precaution to take cross bearings of prominent points and from them plotting the position frequently on the chart; also, the familiar use of the chart in laying courses and correcting the same for variation and deviation.

DANGERS, SOUTH SHORE.

From Duluth to Detour Station on the south shore the whole coast of the main can be approached with safety to $\frac{1}{2}$ mile.

From Detour Station through Apostles Islands to Chaquamegon Bay.—From Detour Point to Red Cliff, thence to Bayfield and to Chaquamegon Bay, there is deep water close along the shore. The NW. shore of the bay is steep-to; at the bottom of the bay the 12-foot curve extends off $1\frac{1}{2}$ miles. Ashland can be approached to $\frac{1}{2}$ mile; Bay City to $\frac{1}{2}$ mile; off Oak Point the 12-foot curve extends westward for 2 miles.

Sand Island.—Shoal water extends from this island to the main shore and the passage between should not be attempted by vessels drawing more than 6 feet.

York Island.—A spit extends from this island $\frac{1}{2}$ mile southerly.

Rocky and South Twin Islands.—These islands are connected by shoal water.

North Twin Island.—A spit extends from this island $\frac{1}{2}$ mile south-westerly.

Outer Island.—Shoals lie one mile north of this island.

Michigan Island.—Two dangerous spots lie $\frac{1}{2}$ mile south of the lighthouse on this island.

Magdalene Island.—A spit extends from the NE. end of this island $\frac{1}{2}$ mile easterly, and from the SW. end of the island a 4-foot spit extends off southwesterly for $\frac{1}{2}$ mile.

From La Pointe Lighthouse to Fourteen Mile Point the coast can be approached to $\frac{1}{2}$ mile, but at Fourteen Mile Point a spit extends off over $\frac{1}{2}$ mile.

Caution.—Vessels should not approach the shore within a depth of 12 feet.

From Fourteen Mile Point to Keweenaw Point.—At one mile NE. of Portage a spit extends $\frac{1}{2}$ mile off shore.

From Eagle River to Eagle Harbor a succession of reefs extend along the shore northeasterly from $\frac{1}{2}$ to $\frac{3}{4}$ mile distant.

Manitou Island.—A rocky flat extends from this island to Gull Rock, as also $\frac{1}{2}$ mile to the NW. from Manitou Island.

Gull Rock.—A shoal of 12 feet of water $\frac{1}{2}$ mile S. $\frac{1}{2}$ E. (S. 2° 48' E.) from the lighthouse. It is marked by a red spar buoy.

From Keweenaw Point to Abbaye Point.—At $\frac{1}{4}$ mile south of Keweenaw Point is a 3-foot spot.

Isabelle Point is surrounded by shoal water to the distance of a mile.

Traverse Island.—Shoal water extends from the SW. end of this island for over $\frac{1}{2}$ mile southwesterly.

Portage Entry is almost filled up by a flat.

Pequaquawaming Point.—A spit extends to the SW. from this point.

Abbaye Point.—A dangerous shoal, buoyed, lies 2 miles east of this point.

Huron River Point.—A large shoal extends $1\frac{1}{2}$ miles NE. from this point.

Big Bay Point.—A dangerous spit with only 8 feet of water extends one mile to the northward from this point.

Little Iron River.—From the point one mile east of this river a spit extends $\frac{1}{2}$ mile to the northward.

Granite Point.—On a line between this point and the northern point of Presqu' Isle are several rocks running parallel to the coast, and Middle Island is in this line.

Marquette Lighthouse.—East of this lighthouse, distant $1\frac{1}{4}$ miles, are rocks and shoal water.

Shot Point and Laughing Fish Point.—A spit extends $\frac{1}{2}$ mile northerly from Shot Point. A spit also extends $\frac{1}{2}$ mile northerly from Laughing Fish Point.

Train Island has shoal water extending from it about a mile to the northward and also to the westward. Between this point and the mainland are several shoals.

Train Point.—Shoals also extend a mile from Train Point to the NW. and for nearly 2 miles northeasterly towards Wood Island.

Wood Island.—Shoal water extends $\frac{1}{2}$ mile from the north point of this island on its western side, and in a direction toward Williams Island.

Williams Island.—There are numerous rocks and sand spits between the south point of this island and the main shore to the south on which there are but 8 and 10 feet of water, making it dangerous for vessels drawing over 8 feet to attempt the passage between the island and the shore.

Sand (or Sandy) Point.—From this point, opposite the beacon on Grand Island, a spit extends to the north and to the NW. for $\frac{1}{3}$ mile, with but 5 feet of water over it.

Point au Sable.—A small spit extends out about $\frac{1}{2}$ mile.

Isle Royale and Vicinity.—There are many detached rocky shoals lying SW. and NW. of the Rock of Ages, distant $1\frac{1}{4}$ miles. Washington Island is surrounded on the south, SW., and NE. by rocky shoals which must be carefully looked out for in making Washington and Grace harbors. Siskiwit Bay has a double set of islets stretching for 8 miles in the general direction of the south shore, connected by sunken reefs and having also

some reefs outside of the islets; vessels should not attempt any of the channels between these islands. The north shore of Isle Royale can be approached with safety to $\frac{1}{2}$ mile. On the NW. coast from McCargoes Cove to Blake Point the shore should not be approached too close. Off the SW. end of Amygdaloid Island there are rocks $\frac{1}{2}$ mile distant, and from the NE. end is a chain of small islands and interlying shoals and rocks terminated by a 4-foot shoal lying $\frac{1}{2}$ mile ENE. from the Canoe Rocks. East of Blake Point, $\frac{3}{4}$ mile, is a 4-foot patch, for which a sharp lookout should be kept. On the east coast from Blake Point to Menagerie Island there are no outlying dangers with the exception of a 4-foot patch ENE. $\frac{1}{2}$ mile from the lighthouse on Menagerie Island. From Menagerie Island going south a clearance of at least a mile should be given the land; this will keep clear of several outlying patches having from 3 feet to 18 feet of water on them, with the deeper water close-to.

Passage Island is safe to approach to $\frac{1}{2}$ mile, but all of these islands should be approached with care, as from their conformation there may be pinnacle rocks heretofore undiscovered by the surveyors.

Gull Island.—There is a reef $\frac{1}{2}$ mile south of Gull Island, and a dangerous spot of 9 feet 2 miles WNW. from the island.

Batteau Rock (Canadian).—East of Batteau Rock, $\frac{1}{2}$ mile, is also a dangerous patch with 3 feet of water thereon.

DANGERS, NORTH SHORE.

From Duluth going north the coast can be approached to a mile.

Granite Point.—Off this point is the Isle aux Roches, with shoal water near and between it and the shore.

Encampment Island is connected with the mainland by a shoal extending to the west and northwest.

Gooseberry River.—Off this river is a dangerous reef $\frac{1}{2}$ mile from shore, of small area, $12\frac{1}{2}$ feet in the shoalest spot; deep water all around it. It is a dangerous obstruction to vessels coasting.

Two Islands River.—Off this river are two rocks or islands, which should be approached with caution.

Rock Island, near the entrance to Good Harbor Bay, should also be approached with care.

Brule River.—One mile west, a little south, from Brule River are two rocks, one above water, the other awash.

Grand Portage Bay.—From the west point of this bay to Pigeon Point are several outlying islands and rocks. Wauswaugoning Bay is comparatively clear, however.

Pigeon Point.—From this point along the north and east coasts to Gros Cap vessels should give the coast good clearance until accurate surveys of

this practically unsurveyed region can be made, the dangers specially warned against being :

Victoria Islands, rocks to the southwestward.

Knob Island, rocks to the southwestward.

Pie Island, rocks to the southeastward.

Thunder Cape, rocks to the southeastward.

Porphyry Point, rocks to the westward and the shoal in center of Black Bay entrance.

Slate Island (Canadian) should be approached with care, especially on the north and NE. coasts, a shoal spot, 10 feet, lying $1\frac{1}{2}$ miles off the north coast, and several rocks the same distance off the NE. coast.

Michipicoten Island (Canadian) is surrounded with outlying shoals and rocks, and should be approached with great caution.

Caribou Island (Canadian) has shoals out from the north, west, and south sides from 2 to 4 miles. It is well to give this island a good berth.

Leach Island (Canadian), **Lizard Island (Canadian)**, **Montreal Island (Canadian)**.—These islands should be approached with extreme caution, especially on the inshore sides, where there are numerous outlying rocks.

Reef.—On a line drawn from the west end of Montreal Island to Point aux Mines, and half way between the two, is a very dangerous shoal having but 5 feet of water on it. This shoal is $\frac{1}{4}$ mile in diameter and bears WSW. $\frac{1}{2}$ W. from the mouth of Montreal River and distant 4 miles therefrom.

Coppermine Point (Canadian) has many rocks near the point and to the northward, while from 4 to 5 miles S. $\frac{3}{4}$ W. is **Pancake Shoal (Canadian)**, which should be carefully avoided.

Sandy Islands (Canadian) should not be approached within 2 miles on the north, west, and south coasts, except by vessels of small draft.

SSW. from Sandy Islands 5 miles, and N. by E. from Parisian Island $2\frac{1}{2}$ miles, is a shoal spot having a least depth of 7 feet thereon.

Parisian Island (Canadian) should be given a berth of at least one mile on account of outlying rocks.

GENERAL REMARKS.

The water of this lake is so clear that objects may be easily distinguished at a depth of 25 feet.

Mirages are frequent and very deceiving.

At its western extremity the shores of Lake Superior converge under a sharp angle. At a point in the angle where the opening is about 9 miles wide a low sand point extends across and incloses a great natural harbor, the Bay of Superior. Only one natural break occurs in it, and here the waters of the St. Louis and Nemadji rivers effect an outlet to the lake. This outlet is near the southern extremity.

Something less than a mile inside this natural breakwater, where the lake

shore lines converge to an opening of about 5 miles, occurs another spit lying substantially parallel to it. Here again the opening is nearest the southern end. It furnishes an outlet for the St. Louis River. The angular opening of the lake behind this spit is a large sheet of water called St. Louis Bay, the upper portion of which is the estuary of the St. Louis River, which river in this locality forms the boundary between the States of Minnesota and Wisconsin.

The exterior formation making out from the north shore is called Minnesota Point. It is about $6\frac{1}{2}$ miles long. That proceeding from the south shore is called Wisconsin Point, and is nearly $2\frac{1}{2}$ miles long. The two have widths varying from 200 to 1,000 feet, and rise but a few feet above the level of the lake.

HARBORS.

Duluth Harbor, Minnesota.—This harbor is said to be the best for entrance of any on the chain of lakes. It is in reality an artificial harbor, having originally been closed to the lake and only accessible by way of the opening formed by the Nemadji and St. Louis rivers. In 1871 a canal was cut through Minnesota Point near the northern end, and a breakwater built in continuation of one already commenced by the Northern Pacific Railroad Company, but in 1872 a storm destroyed this breakwater and it was abandoned. In 1873 the canal passed under Government control. At this time the depth along the principal docks was only 9 feet. It is now intended to dredge and maintain an inner harbor to accommodate vessels drawing 16 feet of water, a channel parallel with the Park Point dock line 100 feet wide, a channel east of Rice Point 200 feet wide and 17 feet deep, and a channel along the north shore of St. Louis Bay 200 feet wide and 17 feet deep. It is expected that the current in the latter channel will help to keep it clear. In view of the depth of water in the new lock of the Sault Sainte Marie Canal it is more than probable that the harbor will eventually be dredged to a depth of 22 feet.

The canal leading into the harbor is 1,165 feet long and 290 feet wide between the piers.

The latest reports give 17 feet as the ruling depth in the canal, and 16 feet in the harbor and channels.

Latest date of opening harbor, June 12, in 1861.

Earliest date of closing harbor, November 9, in 1859.

Current.—There is no perceptible current from the St. Louis River through the canal, but an ebb and flow of water which seems to be due to oscillations of the lake surface, as they change direction too frequently to be caused by tidal action. When heavy winds prevail from the NE. the water is forced to this end of the lake, raising the water in Superior and Duluth bays, and causing a very strong outward set through the Duluth Canal.

This current meeting the incoming waves renders navigation at such times very dangerous.

Pilots.—The captains of all tugs are pilots and pilotage is included in the towing. Rates vary from \$5 to \$100, according to tonnage and distance.

Lights.—On the outer end of the south pier of the canal is a lighthouse, from which is shown a fixed red light visible at a distance of $11\frac{1}{2}$ (13) miles. This light, in connection with a flashing red light every 6 seconds on the inner end of the same pier and 1,165 feet from it, furnishes a range to guide vessels through the canal.

Caution.—Give the end of the south pier a berth of at least 20 feet to avoid the stone riprapping.

Ohio Central Coal Dock Light.—A fixed red light, shown from an upright on a cluster of piles and 13 feet above the lake level. It is in 12 feet of water, southerly of the easterly corner of the Ohio Central Coal Dock, and marks the turning point into the channel marked by the Rice Point Range.

Rice Point Range.—The front light is white and is shown from an upright on a cluster of piles and 13 feet above the lake level. It stands in 7 feet of water southeasterly from Rice Point.

The rear light is red, shown from an upright on a cluster of piles and 18 feet above the lake level, 510 feet SSE. $\frac{3}{4}$ E. (S. 26° 43' E.) from the front light.

These two lights in line guide through the dredged channel, east of Rice Point, from the Ohio Central Coal Dock beacon to the turn round Rice Point to the southwestward.

N. B.—The rear light of this range is also the rear light of Connors Point Range.

Connors Point Range.—The front light is white, in 7 feet of water, southeasterly from Rice Point, and shown from an upright on a cluster of piles, and 13 feet above the lake level.

The rear light is red, 510 feet NE. by E. (N. 56° 15' E.) from the front light, and is also shown from an upright on a cluster of piles, and 18 feet above the lake level.

The two lights in line guide through the dredged channel past Rice and Connors points to the Northern Pacific Railroad bridge at West Superior, crossing the south channel.

N. B.—The rear light of this range is also the rear light of the Rice Point Range.

NOTE.—Wishing to make the north channel from the above range, a course of NW. $\frac{1}{4}$ W. (N. 53° 26' W.), or nearly NW. $\frac{1}{8}$ W. (N. 54° 50' W.), must be headed just before the Superior Bay Channel upper light and the front light of the St. Louis Bay North Channel East Range come in

line. This course will carry to the Northern Pacific Railroad bridge, crossing the north channel.

North Channel East Range (St. Louis Bay).—The front light is white, in 7 feet of water, at the easterly end of the North Channel and westerly of Rice Point. It is shown from an upright on a cluster of piles 13 feet above the lake level.

The rear light is also white, 600 feet NE. $\frac{1}{2}$ E. (N. $46^{\circ} 24'$ E.) from the front light. It is in 7 feet of water and shown from an upright on a cluster of piles 18 feet above the lake level.

North Channel West Range (St. Louis Bay).—The front light is white, 13 feet above the lake level, and shown from an upright on a cluster of piles standing in about 7 feet of water.

The rear light is white, 18 feet above the lake level, 550 feet SW. $\frac{1}{2}$ W. (S. $46^{\circ} 24'$ W.) from the front light. It is shown from an upright on a cluster of piles standing in 7 feet of water.

These lights in range ahead, and the East Range lights in line astern, guide through the North Channel from off Rice Point nearly up to Grassy Point.

N. B.—The rear light of this range is also the rear light of the South Channel Range.

South Channel Range (St. Louis Bay).—The front light is white, 13 feet above the lake level, shown from an upright on a cluster of piles standing in 9 feet of water.

The rear light is white, 18 feet above the lake level and 950 feet WSW. $\frac{1}{4}$ W. (S. $70^{\circ} 19'$ W.) from the front light; it is shown from an upright on a cluster of piles.

These lights in line guide through the dredged channel on the south side of St. Louis Bay from just above the railroad bridge off West Superior to the westward.

N. B.—The rear light of this range is also the rear light of the North Channel West Range.

The clusters of piles referred to above are all square, black, pyramidal, surmounted by a wooden platform and box with an upright of natural color.

Fog Signal.—In connection with the outer lighthouse is a 10-inch steam fog whistle, which, in thick or foggy weather, gives a blast every 5 seconds, with a silent interval of 30 seconds.

ROUTES.

Duluth to St. Marys River.—From Duluth lighthouse steer ENE. $\frac{1}{4}$ E. (N. $70^{\circ} 18'$ E.) for 59 (68) miles, when Devil Island should bear south, thence steer E. by N. (N. $78^{\circ} 45'$ E.) a little northerly, for 107 $\frac{1}{4}$ (124) miles; this should bring a vessel in sight of Eagle Harbor lighthouse

by day or light at night. When the lighthouse bears south distant 5 ($5\frac{1}{2}$) miles, change course to east and continue in this direction for 24 ($27\frac{1}{2}$) miles, until the lighthouse on eastern end of Manitou Island bears south, when shape course ESE. (S. $67^{\circ} 30'$ E.) for 118 ($135\frac{1}{2}$) miles; this should bring a vessel 2 ($2\frac{1}{2}$) miles north of Whitefish Point. The point can be rounded at this distance and when Whitefish Point light bears west, a SE. $\frac{1}{4}$ S. (S. $36^{\circ} 33'$ E.) course for $20\frac{1}{2}$ ($23\frac{1}{2}$) miles should carry a vessel midway between Iroquois Point and Gros Cap, then follow directions for St. Marys River.

Duluth to Eagle River.—From Duluth lighthouse steer ENE. $\frac{1}{4}$ E. (N. $70^{\circ} 18'$ E.) for 59 (68) miles, when Devil Island light should bear south, thence steer E. by N. (N. $78^{\circ} 45'$ E.) for $107\frac{1}{2}$ (124) miles; this should bring a vessel off Eagle River light.

Duluth to Eagle Harbor.—Follow directions Duluth to Eagle River. The coast can then be followed, at not less than a mile distant, from Eagle River to Eagle Harbor entrance.

Duluth to Agate Harbor.—Follow directions Duluth to Eagle Harbor. The coast can then be followed, at not less than a mile distant, from Eagle Harbor to Agate Harbor.

Duluth to Copper Harbor.—Follow directions Duluth to Eagle Harbor. The coast can be followed, at not less than a mile distant, from Eagle Harbor to Copper Harbor.

Duluth to Ontonagon, passing through Apostle Islands.—From Duluth lighthouse steer ENE. $\frac{1}{2}$ E. (N. $73^{\circ} 07'$ E.) for 52 (60) miles, when the passage between York and Raspberry islands will open out, thence steer to the southeastward, keeping about in mid-channel and passing Raspberry Island light at a distance of $\frac{1}{2}$ mile; when the SW. point of Oak Island bears north, change course to eastward, passing north of Hermits Island and midway between Magdalene on the south and Stockton and Michigan islands on the north, remembering the shoals off NE. point of Magdalene and south shore of Michigan islands. When Michigan Island lighthouse bears north, distant not less than $1\frac{1}{2}$ ($1\frac{3}{4}$) miles, change course to E. $\frac{1}{4}$ N. (N. $87^{\circ} 11'$ E.) and continue on this course for $49\frac{1}{2}$ (57) miles, which should bring a vessel off Ontonagon.

Duluth to Ontonagon, passing north of Apostle Islands.—From Duluth lighthouse steer ENE. $\frac{1}{4}$ E. (N. $70^{\circ} 18'$ E.) for 59 (68) miles, until Devil Island bears south, distant about one mile, when steer east for $13\frac{1}{2}$ ($15\frac{1}{2}$) miles, until the NE. point of Outer Island bears south, distant about $1\frac{1}{2}$ ($1\frac{3}{4}$) miles; thence ESE. $\frac{1}{2}$ E. (S. $73^{\circ} 07'$ E.) for $45\frac{1}{2}$ ($52\frac{1}{2}$) miles should bring a vessel off Ontonagon.

Duluth to Bayfield or Chaquamegon Bay.—Use directions Duluth to Ontonagon, passing through Apostle Islands, until SW. point of Oak Island bears north, whence steer to the southward and westward through

West Channel until off Bayfield, or continue on to Chaquamegon Bay. All this shore is steep-to.

Duluth to Beaver Bay.—From Duluth lighthouse steer NE. by E. (N. $56^{\circ} 15' E.$) for $24\frac{1}{2}$ ($29\frac{1}{2}$) miles, until Agate Bay lighthouse bears west, thence NE. $\frac{1}{2}$ N. (N. $39^{\circ} 22' E.$) for 20 (23) miles to Beaver Bay.

Duluth to Washington Harbor.—From Duluth lighthouse steer NE. by E. $\frac{1}{2}$ E. (N. $61^{\circ} 52' E.$) for $130\frac{1}{2}$ ($150\frac{1}{2}$) miles to Rock of Ages, then follow directions for entering Washington Harbor.

Duluth to Silver Islet Landing.—From Duluth lighthouse steer NE. by E. (N. $56^{\circ} 15' E.$) for $148\frac{1}{2}$ (171) miles, until the highest peak on the west end of Pie Island bears NW. $\frac{3}{4}$ N. (N. $36^{\circ} 33' W.$), distant 6 (7) miles, when continue NE. $\frac{3}{4}$ N. (N. $36^{\circ} 33' E.$) for 10 ($11\frac{1}{2}$) miles, till Thunder Cape bears NW., distant $1\frac{1}{2}$ ($1\frac{3}{4}$) miles; thence a NE. by E. (N. $56^{\circ} 15' E.$) course for 5 ($5\frac{3}{8}$) miles to the landing.

About 5 miles east from Duluth lies Superior City, Wisconsin.

Superior, Wisconsin.—Originally the natural entry to Superior Bay was obstructed by shifting bars, with a greatest depth of 9 feet. An attempt was made by the citizens of the city to remedy this by constructing piers to confine the flow of waters from the rivers, and in 1867 the U. S. Government took the matter in charge and since then a ruling depth of 16 feet has been successfully maintained. Of these, Minnesota Point pier is 3,150 feet long, Wisconsin Point pier 2,500 feet long, with 350 feet between the piers.

Superior Bay is quite shallow except where the waters of the St. Louis River form through it a narrow channel. Harbor room for large modern vessels has to be provided by dredging.

The channel between the piers makes an abrupt bend at the point where it enters Superior Bay, consequently a vessel entering during a severe storm has great difficulty in following this channel. This can not be remedied because the Nemadji River enters the bay so near the entrance that the bar which the river maintains will not permit a change in location of the channel.

The Nemadji River is navigable for tugs and vessels of light draft for 4 miles from its mouth.

The channel in Superior Bay has neither the directness nor width to permit vessels to reach Conners Point in safety without the assistance of a tug or pilot; and in rounding from the entrance into Quebec Channel in a high wind, a steam tug is very necessary.

Light.—There is a fixed white light on the outer end of the south pier, which is visible $12\frac{1}{2}$ ($14\frac{1}{4}$) miles.

Fog Signal.—A 6-inch steam whistle is on the outer end of the south pier, and sounds a blast of 3 seconds followed by a silent interval of 12 seconds during thick weather.

Superior Bay Entrance Range.—The front light is white, 18 feet above the lake level and shown from a white, wooden upright, just inside the southeasterly entrance to Superior Bay and on Wisconsin Point.

The rear light is white, 24 feet above the lake level and shown from a white, wooden upright, 320 feet SW. by W. $\frac{1}{8}$ W. (S. $57^{\circ} 39'$ W.) from the front light.

This range in line guides through the natural channel from Lake Superior into the southeasterly end of Superior Bay.

Superior Bay Range.—The front light is white, 16 feet above the lake level on a white wooden upright on Wisconsin Point, close to the west end of the south pier.

The rear light is white, 21 feet above the lake level, on a wooden upright, 290 feet SE. $\frac{1}{4}$ E. (S. $53^{\circ} 26'$ E.) from the front light.

This range in line guides up Superior Bay from inside the entrance, past the old dock on Minnesota Point, to the entrance to the dredged channel to Quebec Dock.

Quebec Channel light.—A fixed red light, 13 feet above the level of the lake and shown from an upright on a cluster of piles standing in 7 feet of water in the west angle formed by the intersection of the main channel with the dredged Quebec Channel.

It marks the entrance to Quebec Channel.

Superior Bay Channel lower light.—A fixed white light, 13 feet above the lake level, shown from an upright on a cluster of piles standing in 13 feet of water, on the NE. side of the main channel, and 3,500 feet NW. from Quebec Channel light.

Superior Bay Channel lower middle light.—A fixed white light, 13 feet above the lake level, shown from an upright on a cluster of piles standing in 15 feet of water on the NE. side of the main channel, and 3,800 feet NW. $\frac{1}{4}$ W. (N. $53^{\circ} 26'$ W.) from the lower light.

Superior Bay Channel upper middle light.—A fixed white light, 13 feet above the lake level, shown from an upright on a cluster of piles standing in 14 feet of water on the NE. side of the main channel and 4,700 feet NW. $\frac{1}{8}$ W. (N. $54^{\circ} 50'$ W.) from the lower middle light and about midway of the middle ground.

Superior Bay Channel upper light.—A fixed white light, 13 feet above the lake level, shown from an upright on a cluster of piles standing in 12 feet of water on the NE. end of the middle ground and NE. side of the main channel. It is 2,000 feet NW. from the upper middle light.

All the above lights, excepting the pier headlight, are tubular lanterns, and the clusters of piles are square, black, pyramidal, surmounted by a wooden platform and box with an upright of natural color.

St. Louis Bay.—NW. from a line joining Rice Point and Connors,

Point lies St. Louis Bay, a continuation of Superior Bay and the outlet of the St. Louis River, which enters it at Grassy Point.

West Duluth occupies the north shore and West Superior is now stretching up the southern side.

Eight miles in a direct line from Grassy Point is Fond du Lac, but by the river it is 15 miles. There is very little fall to the river except for the upper mile.

This portion of the river is now being improved.

Pilots.—The same as mentioned under Duluth.

Routes.—The routes from Superior to the entrance of St. Marys River, as also to the different ports on the lakes, are practically the same as from Duluth, with the exception of that to Agate Bay.

Coast.—The coast from Superior to the NE. is low, although bold, and there are no refuges from the winds from the north and NE. Thirty-five and a half (41) miles from Superior, Bark Point with Bark Bay offers protection from all westerly winds. The bay is $2\frac{1}{2}$ miles deep northeasterly and southwesterly. On the east side of Bark Bay a small, though high, point, separates it from Siskiwit Bay. Both of these bays afford protection from southerly winds.

From this point vessels of all but very light draft must run outside of Sand Island on account of the bar connecting Sand Island with the mainland, which has but 5 or 6 feet of water on it at extreme low water. Passing from Siskiwit Bay outside of Sand Island give Eagle and Steamboat islands a good berth on account of the shoal spots which surround and connect them.

Sand Island is the most western of the Apostle Group, which group comprises 19 islands, extending 29 miles ENE. and WSW. This island can be approached close to on the north and west coasts, but great care should be exercised when on the south and SE. sides. On its extreme north point is a lighthouse.

Light.—A fixed white light, visible 13 (15) miles in clear weather is on top of an octagonal, red sandstone tower, which rises from a sandstone building.

Vessels taking the outside route continue their course to the NNE. passing north of

Devils Island.—This island is the extreme northern one of the group and on its northern point is a

Light.—A fixed red light, visible $11\frac{1}{2}$ (13) miles in clear weather, exhibited from a square, white, pyramidal, open framework tower, the upper part of which is inclosed.

Fog Signal.—Five hundred feet NW. of the lighttower is a 10-inch steam whistle, which sounds a blast of 5 seconds duration followed by a silent interval of 10 seconds, then a blast of 5 seconds duration followed

by a silent interval of 40 seconds. This occurs every minute during thick weather.

Continuing the outside course, vessels would here change their course to about east and pass to the north of

Outer Island, the most northeastern of the group. A shoal lies one mile north of this island. About the middle of its northern shore is a lighthouse.

Light.—A flashing white light, every 90 seconds, visible $17\frac{1}{2}$ (20) miles in clear weather. It is exhibited from the top of a conical, white, brick tower, which is connected by a covered way with a brick dwelling. NW. from the lighthouse is a

Fog Signal.—A 10-inch steam whistle sounds a blast of 8 seconds followed by a silent interval of 52 seconds.

From Outer Island vessels can shape their course to any ports to the eastward.

Sand Island light marks the turning point for vessels bound to Bayfield or Ashland, as also for those taking the route through the Apostle Group and bound for ports further to the eastward.

It is not advisable to pass to the west of York Island, as shoal water extends off its SW. and south shores; vessels therefore pass to the NE. of the island and keep close to

Raspberry Island.—Passing to the southward of this island, on the extreme SW. point of which is a

Light.—A fixed white light varied by a white flash every minute, and visible $14\frac{1}{2}$ ($16\frac{1}{2}$) miles in clear weather. It is exhibited from the top of a square tower on a white frame building.

All through these islands the shores can generally be approached close-to, but by keeping an approximate mid-channel course vessels will be sure of good water.

The south shore of Stockton (Presqu' Ile) Island, affords good anchorage from northerly winds, and all the larger islands from westerly winds.

Passing between Oak Island and Red Cliff, both of which are comparatively high, vessels bound through the West Channel keep a midway course until off Bayfield.

Bayfield is an open roadstead with deep water up to the docks. While protected from westerly gales, during NE. gales vessels have to run under La Pointe, Magdalene Island, for anchorage.

Bayfield to Ontonagon by South Channel.—Leaving Bayfield steer south for about 4 ($4\frac{1}{2}$) miles until La Pointe lighthouse bears SE., when change course to E. $\frac{1}{4}$ N. (N. $81^{\circ} 33'$ E.) for 62 ($71\frac{1}{2}$) miles, keeping at least one mile off shore along the Porcupine Mountains. This should bring a vessel off Ontonagon.

By North Channel.—Leaving Bayfield steer through North Channel for $8\frac{1}{2}$ (10) miles until the north end of Magdalene Island bears south, when

change course to the southeastward and pass about midway between Magdalene and Michigan islands, remembering the shoals off these islands. When the lighthouse on Michigan Island bears north $1\frac{1}{2}$ ($1\frac{3}{4}$) miles (not less), set course E. $\frac{1}{4}$ N. (N. $87^{\circ} 11'$ E.) for $49\frac{1}{2}$ (57) miles, which should bring a vessel off Ontonagon. With winds from northward and eastward it would be better for a sailing vessel to pass between Stockton and Michigan islands, giving the north point of the latter island a berth of at least 3 ($3\frac{1}{2}$) miles before shaping course for Ontonagon.

Bayfield to Beaver Bay.—Leaving Bayfield, steer mid-channel through West Channel, until the SW. point of Oak Island bears north, distant about a mile, when change course to the northward and westward, passing midway between Raspberry and York islands. When the north end of York Island bears south, steer NW. $\frac{1}{4}$ W. (N. $47^{\circ} 48'$ W.) for $21\frac{1}{4}$ (25) miles, which should bring a vessel off Beaver Bay.

Bayfield to Silver Islet Landing.—Leaving Bayfield steer through the North Channel for $8\frac{1}{2}$ (10) miles until the north end of Magdalene Island bears south and Michigan Island lighthouse E. by S. (S. $78^{\circ} 45'$ E.), when change course to east for $3\frac{1}{2}$ (4) miles until the SE. point of Stockton Island, off which the chart shows 4 fathoms, rock bottom, bears north, thence steer NE. $\frac{1}{2}$ N. (N. $39^{\circ} 22'$ E.) for $75\frac{1}{2}$ (87) miles until Rock of Ages bears east, thence NE. $\frac{3}{4}$ N. (N. $36^{\circ} 33'$ E.) for $31\frac{1}{4}$ ($36\frac{1}{2}$) miles until Thunder Cape bears NW., distant $1\frac{1}{2}$ ($1\frac{3}{4}$) miles, thence NE. by E. (N. $56^{\circ} 15'$ E.) to the landing.

Running south from Bayfield the coast is bold and can be approached close-to. Rounding Houghton Point the town of

Washburn is seen. Here are two docks extending into deep water and connected by a bulkhead.

Lights.—Two private lights are here exhibited, both red; one on the end of a warehouse on one dock, and on the other dock one from a window in the elevator.

Washburn is at the west entrance to

Chaquamegon Bay, the eastern point of which bears the same name. Chaquamegon Point is a low, narrow spit 6 (7) miles in length and forms a partial natural breakwater to the bay, much as Minnesota Point offers to Superior Bay. At its NW. end is a lighthouse.

Light.—A fixed red light, visible in clear weather $11\frac{1}{2}$ (13) miles, is exhibited from a square tower on a white frame dwelling.

Fog Signal.—A 10-inch steam whistle sounds a blast of 5 seconds, followed by a silent interval of 25 seconds.

This lighthouse is known as La Pointe, and serves as a guide for South Channel, as also for the turning point for Chaquamegon Bay.

This bay has deep water along its western shore $5\frac{3}{4}$ ($6\frac{1}{2}$) miles south of Washburn, when shoaling water commences. On the east side of the bay

shoaling water commences on a line joining the lighthouse and the mouth of Fish Creek. Vessels should be careful of soundings when to the east of this line. Give La Pointe lighthouse a good berth.

The southern end or head of this bay forms the harbor of

Ashland, and as the length of the bay is considerable it was necessary to protect the wharves from the waves to enable vessels to use them at all times. When the proposed breakwater is finished it will be 8,000 feet long. It is as yet of insufficient length to give protection to all the wharves of the city, but its influence in diminishing the turbulence of the waters of the harbor is distinctly apparent. Its total length was, at the last report, 5,680 feet. The routes from Ashland are approximately the same as from Bayfield to other ports, making La Pointe lighthouse the point of departure.

Keeping to the eastward of the Apostle Islands, Magdalene Island can be approached close to except at the NE. point, which should be cleared by one mile at least. On the south point of Michigan Island is a

Light.—A fixed white light, visible $17\frac{1}{2}$ (20) miles, is shown from a conical, white, stone tower attached to a stone dwelling.

Coast.—From Chaquamegon Point eastward the coast is low, commencing to rise about Clinton Point and continuing until Porcupine Mountains are reached, where a height is recorded of 2,023 feet by the U. S. Lake Survey at a geodetic station. Beyond the Union River the coast again becomes low. Into Oronto Bay, $18\frac{1}{2}$ ($21\frac{1}{2}$) miles from Chaquamegon Point, empties the Montréal River, which forms part of the boundary line between Wisconsin and Michigan.

At $61\frac{1}{2}$ ($70\frac{1}{2}$) miles in a straight line from South Channel lies

Ontonagon.—The Ontonagon River, forming the harbor, has fairly deep water in it, but its mouth is obstructed by a bar with varying depths. In order to maintain a sufficient depth of water two parallel piers have been built, the east pier being 2,315 feet in length and the west pier 2,675 feet. During freshets large quantities of sand are carried by the river, and the bar at the entrance forms as fast as the piers are extended. The channel over the bar is shifting and uncertain. There is an available depth of $13\frac{1}{2}$ feet through, and along the inner half of over 16 feet.

Lights.—A fixed white light, visible $12\frac{1}{2}$ (14) miles in clear weather, at the mouth of the Ontonagon River, is exhibited from a square, yellow brick tower rising from a dwelling.

A fixed red light (lantern) is shown from a square, brown, pyramidal, open framework tower, upper part inclosed, on the west pier, 45 feet from the outer end. There is an elevated walk along the pier to the shore.

Ontonagon to Copper Harbor and Intermediate Points.—When 3 miles north of Ontonagon light steer NE. $\frac{1}{4}$ E. (N. $53^{\circ} 26'$ E.) for 52 (60) miles, until Eagle River lighthouse bears SE., thence follow around the coast at not less than one mile distant, until off Copper Harbor.

For making Portage Lake, Eagle River, Eagle Harbor, and Agate Harbor, see special directions under the several heads.

Ontonagon to Manitou Passage and Marquette.—Follow directions above until off Copper Harbor, when continue rounding the coast at not less than a mile, passing in mid-channel between the coast and Gull Rock lighthouse until this lighthouse bears NE., when set course S. by E. $\frac{1}{2}$ E. (S. $16^{\circ} 52'$ E.) for 50 (57) miles, passing $\frac{1}{2}$ mile east of Granite Island, this should bring a vessel 2 ($2\frac{1}{4}$) miles NE. of the northern end of Presqu' Isle. Keep a lookout for the rocks extending $\frac{3}{8}$ mile north from this island, and steer south for 4 ($4\frac{1}{2}$) miles until off Marquette.

Ontonagon to St. Marys River.—Follow directions to Copper Harbor. When off Copper Harbor steer ESE. $\frac{1}{4}$ E. (S. $70^{\circ} 18'$ E.) for 127 ($146\frac{1}{2}$) miles, passing $1\frac{1}{2}$ miles north of Manitou Island. This should bring a vessel about 2 ($2\frac{1}{4}$) miles north of Whitefish Point, which can be rounded at this distance, and when Whitefish Point bears west a SE. $\frac{3}{4}$ S. (S. $36^{\circ} 33'$ E.) course for $20\frac{1}{2}$ ($23\frac{1}{2}$) miles should carry a vessel midway between Iroquois Point and Gros Cap; thence follow directions for St. Marys River.

Ontonagon to Portage Entry.—See directions to Manitou Passage. When Gull Rock light bears NE. $\frac{1}{4}$ E. (N. $47^{\circ} 48'$ E.), bring it astern and steer SW. $\frac{1}{4}$ W. (S. $47^{\circ} 48'$ W.) for 39 (45) miles; this should bring a vessel off Portage Entry.

Ontonagon to Silver Islet Landing.—Leaving Ontonagon steer N. $\frac{1}{4}$ W. (N. $2^{\circ} 49'$ W.) for 59 (68) miles until Rock of Ages bears east, thence follow directions Bayfield to landing.

Ontonagon to Beaver Bay.—Leaving Ontonagon steer WNW. $\frac{1}{2}$ W. (N. $73^{\circ} 07'$ W) for $46\frac{1}{2}$ ($53\frac{1}{2}$) miles until the NE. point of Outer Island bears south, thence a course WNW. $\frac{3}{4}$ W. (N. $75^{\circ} 51'$ W.) for $37\frac{1}{2}$ ($43\frac{1}{2}$) miles should bring a vessel off Beaver Bay.

Fourteen Mile Point, as its name indicates, is 12 (14) miles east from Ontonagon.

Fourteen Mile Point Light.—A fixed white light, varied by a red flash every 20 seconds, is shown from a square red tower, rising in the center of the front of a red dwelling with a red roof. The watchroom and lantern are black. It is 60 feet above the lake level, and is visible in clear weather $13\frac{1}{2}$ ($15\frac{1}{2}$) miles.

Fog Signal.—A 10-inch steam whistle will sound blasts of 5 seconds, followed by silent intervals of 25 seconds.

Off this point a spit makes out with $2\frac{1}{4}$ fathoms on its outer edge; vessels should approach it with caution.

Beyond Fourteen Mile Point the land rises as Keweenaw Point is approached.

Keweenaw Point is a rocky promontory, projecting into the lake in a northeasterly direction. It is 55 (64) miles long and 25 (29) miles wide at its base, with a coast line of 120 (140) miles. The shores of this promontory are bold, with outlying reefs, dangerous to navigation, and with no good harbors to afford refuge in storms. About $35\frac{1}{2}$ (40) miles from its extremity the promontory is cut in a northerly and southerly direction for 14 (16) miles by a natural navigable channel known as Portage Lake, which occupies a narrow and deep chasm. It receives also from the NE. the waters of Torch Lake. Its outlet is Portage River, which empties into Keweenaw Bay. The original draft in this river was but from 3 to 5 feet. During the war a company was formed to cut from the north end of Portage Lake into Lake Superior. This necessitated a canal 2 miles long, 13 feet deep, and 100 feet wide, and the building of a breakwater at its entrance on Lake Superior.

Portage River, having but shallow draft and a tortuous channel, obstructed by two bars, one at its exit from the lake, the other at its entrance to the bay, had to be improved, a tolerably straight canal cut, with a depth of 14 feet and an average width of 100 feet; at the bay entrance a pier built 675 feet long and terminating in 14 feet of water, its width from 25 to 30 feet. All of these improvements were made by private individuals. On August 3, 1891, the United States assumed entire control of the waterway from the western shore of Keweenaw Point to Keweenaw Bay on the eastern shore. It is now (1894) intended to maintain a 16-foot channel, with a bottom width of 70 feet, from Keweenaw Bay to Lake Superior; to reconstruct the piers at the western entrance and to extend them out to a 30-foot depth; to extend the eastern entrance pier to a 20-foot depth, and sometime in the future to increase the channel to a 20-foot depth with a corresponding width of 100 feet.

Portage Lake Canal is the west entrance to this system of lakes and canals.

Lights.—One fixed white light, visible 13 (15) miles, is at the west side of the cut and shown from a square, red brick tower, on the canal front of dwelling.

One fixed red light on the end of the west pier, visible $7\frac{1}{2}$ ($8\frac{1}{2}$) miles and exhibited from a square, white pyramidal, open framework tower, the upper part of which is inclosed. It serves as a guide into the canal.

Fog Signal.—A bell struck every 20 seconds, by machinery.

There is an elevated walk from the lighthouse along the pier to the end.

Life Saving Station.—Three-fourths of a mile from the north end of the canal, on the east bank.

Directions.—The light at the outer end of the west pier with the lighthouse at the inner end serves as a guide to and into the west entrance of the

canal. From this the canal runs in a S. 23° E. direction until a short distance beyond the U. S. Life Saving Station, when it changes direction to the south, passing through Lilly Pond and entering Portage Lake at Monders. Here project two bulkheads and at the extremity of the eastern one is a canal light.

Vessels drawing 14½ feet of water can now pass through the Portage River and upper ship canal.

At the head of Portage Lake a target is placed on a range back from the light on the outer end of the new pier to show a line of greatest depth of water. The roof of the lighthouse has been painted red and a red light is placed on it at night.

Keeping to the southward a general course of S. 29° E. is made until Oscar is passed, thence S. 18° E. as a general course. Having rounded the bend just below Swedetown Creek, Hancock and Houghton are passed. These towns lie, Hancock on the north and Houghton on the south side of Portage Lake, 8½ (10) miles from the west entrance, and are the principal shipping ports of this lake. A short distance east of Houghton a course S. 69° E. will carry clear of danger until about midway between the entrance of Pilgrim River and Dollar Bay. From here a course of S. 15° E. will carry through the wide part of the lake and to the north entrance of Portage River. From here on a mid-channel route, passing through Cuts Nos. 4, 3, and 2, will carry to and past the range lights for Cut No. 1.

Range Lights.—A fixed white light, visible 10½ (12) miles and shown from a square tower on white frame dwelling, is 730 feet N. ¼ W. (N. 8° 26' W.) from

A fixed white light, visible 10 (11) miles and exhibited from a square tower. This latter light is on the west side of the Portage River, near its mouth.

These lights serve as a range on which vessels can run on leaving or entering the harbor and passing through Cut No. 1.

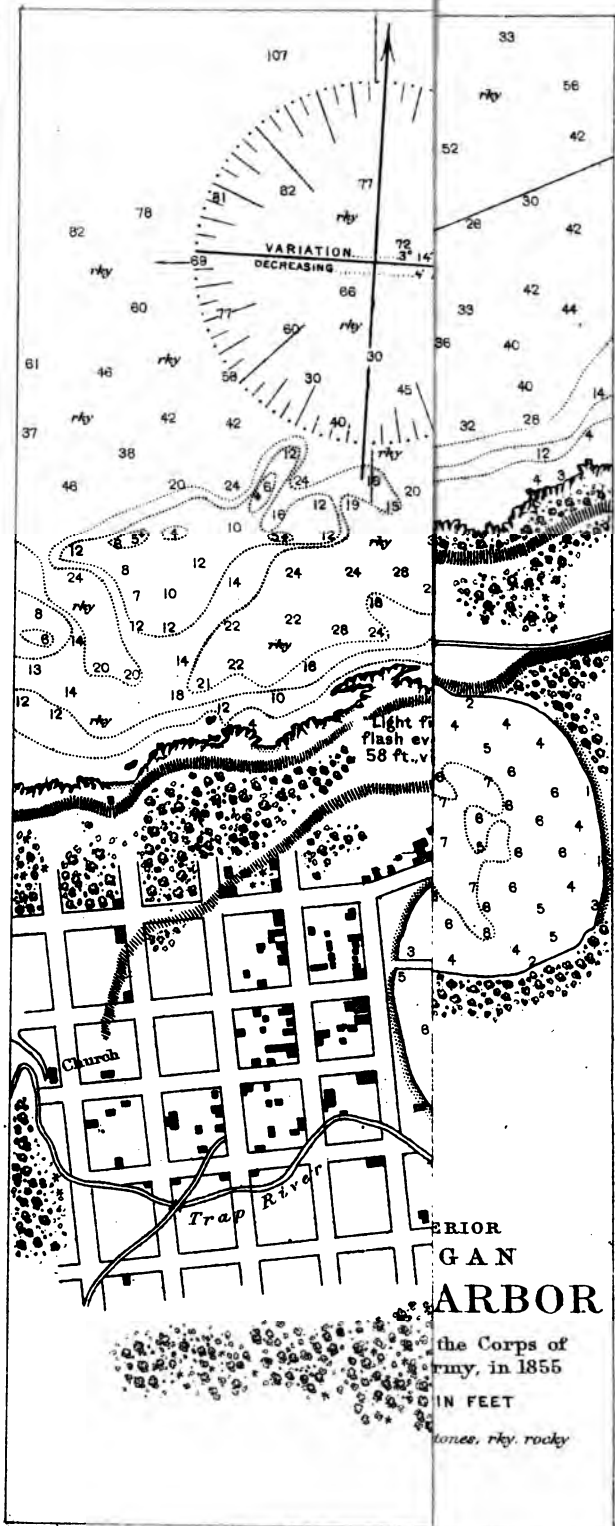
In this system there are no locks.

The improved parts of the channel will be kept well buoyed.

The harbor on the Keweenaw Bay side is exposed to all storms from north and east, and there is no good anchorage within 9 miles.

Light.—A fixed white light, varied by a red flash every minute, and visible 13 (15) miles, is shown a little to the eastward of the entrance to Portage River, from a cylindrical, white stone tower, connected with a red brick dwelling by a covered way.

Proceeding to the northeastward from Portage Lake Canal a shoal makes out for about a mile to the northward of the harbor, another a little to the southward of the north of Gratiot River, and from there on to Eagle River the shore should be given a good berth.



PRIOR
POINT
HARBOR

the Corps of
Army, in 1855
IN FEET

stone, rky. rocky

Eagle River Harbor is practically abandoned as a commercial port. There is a pier which is falling to pieces and the channels are filling gradually. There are shoals, $\frac{5}{8}$ of a mile off shore, NW. and NNE. of the mouth of the river with from 6 to 10 feet of water on them and a channel between them and the beach; this channel is about 20 feet in depth. The shoals extend 2 miles in a NE. and SW. direction. Approaching from the west, head ESE. $\frac{1}{2}$ E. (S. $73^{\circ} 07'$ E.) for the north end of the pier and run in on that heading until close to the dock, when head up to the northward. Approaching from the NE. and through the passage between the shoals head S. $\frac{1}{4}$ W. (S. $2^{\circ} 48'$ W.) for the end of the pier, and run down on this heading.

Light.—There is a fixed white light, shown from a lens lantern on a square, white stone tower on a dwelling.

Vessels coasting should keep well clear of the land running in either direction.

Eagle Harbor is $6\frac{1}{2}$ ($7\frac{1}{2}$) miles from Eagle River and is one of the harbors of refuge on the south shore of Lake Superior. Through a rocky ledge, with $8\frac{1}{2}$ feet of water at the shoalest part, which originally obstructed the entrance to the harbor, a channel, 130 feet wide and 14 feet deep, has been dredged.

This channel is marked by two guiding cribs, one on either side. It was completed in 1879. The course going in is SSE. $\frac{1}{2}$ E. (S. $28^{\circ} 07'$ E.) on the range on the south shore of the bay. This course will carry clear of a shoal lying north of the entrance, about $\frac{1}{4}$ mile distant.

Light.—On the west point of the entrance there is a fixed white light, varied by a white flash every minute, visible 13 (15) miles in clear weather. It is shown from a red brick tower, octagonal in shape, rising from the corner of a dwelling.

Range Lights.—On the south shore are two lights, which show the range at night, the towers mark it by day.

The Front Light is a fixed white tubular lantern light shown from a white frame tower and is 20 feet above the lake level.

The Rear Light is 1,000 feet SSE. $\frac{1}{2}$ E. (S. $28^{\circ} 07'$ E.) from the front light, of the same character, and is 29 feet above the lake level. It is shown from a square tower on a frame dwelling.

Approaching by the east channel bring the lighthouse to bear WSW. (S. $67^{\circ} 30'$ W.) and run in on this course until on the range, when head in, passing between the cribs.

From Eagle Harbor to Agate Harbor the coast is dangerous and should be avoided, especially in the vicinity of

Agate Harbor.—This harbor is $4\frac{1}{2}$ (5) miles from Eagle Harbor, is surrounded by shoals, and when inside there are many shoal spots. It no longer used as a harbor of refuge.

The target, which was used as a guide, is still in existence, and to enter the harbor, head for the target on a course SSE. $\frac{1}{2}$ E. (S. $28^{\circ} 07'$ E.) until the houses on the south shore of South Harbor are seen clear of Agate Point, then steer E. $\frac{1}{2}$ N. (N. $84^{\circ} 22'$ E.) to anchorage in North Harbor.

Copper Harbor, 8 ($9\frac{1}{2}$) miles nearly east of Agate Harbor, is a good natural harbor having a narrow bar with a least depth on it, when on the range, of 16 feet. It is protected from the waves by the mainland, Porters Island, and the shoals, and affords good anchorage, being 2 miles long and 1,200 feet wide. The town of Copper Harbor is on the SW. side.

Light.—A fixed white light, visible $13\frac{3}{4}$ ($15\frac{3}{4}$) miles in clear weather is on the east point of the entrance to the harbor and is shown from a square, yellow brick tower, which rises from a dwelling.

Range Lights.—On Fort Wilkins military reservation on the south shore, a fixed white lens lantern serves as the front light of a range for the channel in the bar. It is exhibited from a white frame tower and is 22 feet above the lake level. 470 feet S. by W. $\frac{1}{8}$ W. (S. $12^{\circ} 39'$ W.) from the front light is a second light of the same character, exhibited from a square tower on a white dwelling and 39 feet above the lake level.

Head in on this range, S. by W. $\frac{1}{8}$ W. (S. $12^{\circ} 39'$ W.), until well past the rocks which show on the west side of the range, when head for the town, anchoring nearer to the north shore for the better protection.

Copper Harbor is the last port on this part of the promontory.

When rounding the promontory to the southward Manitou Island and Gull Rock are sighted.

Gull Rock is about $\frac{1}{2}$ mile from the west end of the island and is surmounted by a lighthouse.

Light.—A fixed red light, visible $11\frac{1}{2}$ (13) miles, is shown from a square, yellow brick tower rising from a dwelling.

Buoy.—A 16-foot spar buoy, painted red, marks a gravelly shoal $\frac{7}{8}$ of a mile S. $\frac{1}{4}$ E. (S. $2^{\circ} 48'$ E.) from Gull Rock lighthouse. This shoal has but 12 feet of water on it.

Manitou Island is $2\frac{1}{2}$ (3) miles long and one mile wide, and should be given a good berth, having shoal water near it, especially on its western side.

Light.—On the east point of the island a fixed white light, varied by a white flash every minute, is shown from a brown, skeleton, iron tower, which has a cylindrical staircase and is connected with a white frame dwelling by a covered way. It is visible $14\frac{3}{4}$ (17) miles in clear weather.

Fog Signal.—A little way east of the lighthouse a 10-inch steam whistle sounds a blast of 3 seconds followed by a silent interval of 26 seconds, then a blast of 5 seconds followed by a silent interval of 26 seconds. This occurs every minute during thick weather.

Coast.—From Keweenaw Point (small) the coast trends away westwardly, and Bete Grise Bay is the first anchorage on the eastern side of the promontory. This bay offers good protection to all winds from the SW. to NE. by way of west and north. At its head, 10 ($11\frac{1}{2}$) miles from the point, is a ship canal, which gave outlet to Lac la Belle. The town of Mendota is here, but it is practically dead, and the canal is not kept up. On the south shore there are shoals and rock extending out over a mile from Isabelle Point, the southern point of Bete Grise Bay. To the southward, past Traverse Point, to the mouth of the Portage River, care should be exercised in approaching the coast.

Traverse Island lies S. by W. $\frac{3}{4}$ W. (S. $19^{\circ} 41'$ W.) of Traverse Point, distant $4\frac{1}{2}$ ($4\frac{3}{4}$) miles. There is shoal water around this island and a spit extends SW. about one mile from it.

Portage River is on Keweenaw Bay; it is described on page 17, as is also the light just to the eastward of its mouth.

Portage Entry to Manitou Island Passage.—When $1\frac{1}{2}$ (2) miles ESE. of Portage River lighthouse steer NE. $\frac{1}{4}$ E. (N. $47^{\circ} 48'$ E.) for 39 (45) miles to a point in mid-channel about $1\frac{1}{4}$ ($1\frac{1}{2}$) miles from Gull Rock lighthouse; the course given leads direct to Gull Rock.

Portage Entry to Marquette.—When $1\frac{1}{2}$ (2) miles ESE. of Portage River lighthouse steer E. $\frac{1}{4}$ N. (N. $87^{\circ} 11'$ E.) for $15\frac{1}{2}$ (18) miles, until Huron Island lighthouse bears south distant $1\frac{1}{4}$ ($1\frac{1}{2}$) miles, when change course to SE. by E. $\frac{3}{4}$ E. (S. $64^{\circ} 41'$ E.) for $15\frac{1}{2}$ (18) miles until Big Bay Point bears SW., distant 2 ($2\frac{1}{4}$) miles; thence a SE. $\frac{1}{2}$ S. (S. $39^{\circ} 22'$ E.) course for 19 (22) miles should bring a vessel 2 ($2\frac{1}{4}$) miles NE. of the north point of Presqu' Ile, whence, remembering the shoals east of the north point of Presqu' Ile, a south course for 4 ($4\frac{1}{2}$) miles should take a vessel off Marquette.

Portage Entry to St. Marys River.—When $1\frac{1}{2}$ (2) miles ESE. of Portage River lighthouse steer E. $\frac{1}{4}$ N. (N. $87^{\circ} 11'$ E.) for $15\frac{1}{2}$ (18) miles until Huron Island light bears south, thence E. $\frac{1}{2}$ S. (S. $84^{\circ} 22'$ E.) for 126 (145) miles should bring a vessel 2 ($2\frac{1}{4}$) miles north of Whitefish Point. The point can be rounded at this distance and when Whitefish Point bears west, a SE. $\frac{3}{4}$ S. (S. $36^{\circ} 33'$ E.) course for $20\frac{1}{2}$ ($23\frac{1}{4}$) miles should carry a vessel midway between Iroquois Point and Gros Cap, then follow directions for St. Marys River.

Portage Entry to Grand Island Harbor.—When off Huron Island lighthouse, as in previous directions, steer SE. by E. $\frac{3}{4}$ E. (S. $64^{\circ} 41'$ E.) for $57\frac{1}{4}$ (66) miles. This should bring a vessel 3 ($3\frac{1}{4}$) miles west of Grand Island lighthouse and with the range lights at the head of the harbor bearing S. by E. $\frac{1}{2}$ E. (S. $16^{\circ} 52'$ E.). See special directions for entering.

Keweenaw Bay.—The west shore of this bay trends to the south from Portage River. There is no break in the shore line until

Sand Point is reached, 12 (14) miles away, to the west of which is an excellent harbor. When $\frac{1}{2}$ mile east of Sand Point, run SW. by S. (S. $33^{\circ} 45'$ W.) not quite a mile, when head up for Baraga on a course of WNW. $\frac{1}{2}$ W. (N. $73^{\circ} 07'$ W.) having due regard for a spit which makes to the southwestward about 300 or 400 yards.

Light.—A fixed red light, visible $8\frac{1}{2}$ ($9\frac{1}{4}$) miles, is shown from Sand Point lighthouse. The lighthouse is a square, red brick tower, rising from a dwelling.

Two miles from Sand Point and at the head of Keweenaw Bay lies the little town of L'Anse.

From L'Anse the shore line keeps off to the north and NE. until

Pequaquawaming Point is reached. This point forms the most secure anchorage near Portage River entrance, the south side giving protection from gales from the north and east, the north side from southerly gales. The only danger around the point is a spit extending a mile SSW. from the SW. point; by running in until 4 fathoms are found will give good anchorage.

From this point the coast trends NE. and 6 (7) miles from the point, a spit having 18 feet on it runs out a mile. The NE. extremity is known as Abbaye Point and is surrounded by dangerous spots. Give it a wide berth. This point forms the west shore of Huron Bay which is $10\frac{1}{2}$ (12) miles deep by a mile wide.

Huron Bay affords good anchorage, and a vessel can ride out nearly all winds in it, especially if in the bay to the southward of Sand Point.

There was a temporary light shown from a tower on Sand Point. The tower still remains, the light is no longer shown. With Huron light dead astern a WSW. $\frac{3}{8}$ W. (S. $71^{\circ} 43'$ W.) course will carry in; a course of SW. $\frac{5}{8}$ W. (S. $52^{\circ} 01'$ W.) from the first low sandy point on the east shore will carry to Sandy Point, which can be approached close-to. Off Valley Creek a sand bar with but 2 feet of water on it makes half way across the bay, with a breadth of $\frac{1}{2}$ mile.

From the most NE. point of Huron Bay the coast trends to the east and here the Huron River empties into the lake. NNE. (N. $22^{\circ} 30'$ E.) and distant $3\frac{1}{2}$ (4) miles lies the westernmost of the

Huron Islands, on which is a

Light.—A fixed white light, visible $20\frac{1}{2}$ ($23\frac{1}{2}$) miles, from a square, granite tower rising from a dwelling.

Fog Signal.—On the NW. corner of the same island, a 10-inch steam whistle gives a blast of 8 seconds, followed by a silent interval of 52 seconds.

This group consists of two islands, the shores are bold except for two small patches of rock off the east end of East Huron. There is a channel

over 2 miles wide between the islands and the mainland, as also a channel between the two islands.

Coast.—The Huron Mountains, one peak of which is 1,532 feet high, are here seen rising back from the lake. About 4 ($4\frac{1}{2}$) miles from the East Huron Island and off Huron River Point is a shoal spot extending to the NE. $1\frac{1}{4}$ ($1\frac{1}{2}$) miles; this should be carefully avoided. From here to the eastward there are no outlying dangers until Big Bay Point is reached, off which a shoal, having but 7 feet on it, extends over one ($1\frac{1}{4}$) miles N. by W. (N. $11^{\circ} 15'$ W.). From Big Bay Point the coast takes a general SSE. direction. A short distance from Big Bay Point shoal another small shoal makes out from the land, and near Garlic Point some rocks lie near the shore. ENE. (N. $67^{\circ} 30'$ E.) from Garlic Point and N. by E. $\frac{7}{8}$ E. (N. $21^{\circ} 05'$ E.) from Granite Point lies

Granite Island. Light.—A fixed white light, varied by a red flash every 90 seconds, visible $15\frac{1}{2}$ ($17\frac{3}{4}$) miles, is shown from a square tower attached to a dwelling, both being built of granite. It is visible around the horizon.

Fog Signal.—A bell struck by machinery every 12 seconds during thick weather.

At a distance of $28\frac{1}{2}$ (33) miles N. by E. $\frac{1}{2}$ E. (N. $16^{\circ} 52'$ E.) of Granite Island is

Stannards Rock.—A dangerous shoal spot extending N. by W. (N. $11^{\circ} 15'$ W.) and S. by E. (S. $11^{\circ} 15'$ E.) 2,910 feet, with a width of 1,500 feet; having deep water close-to, and distinguished by a beacon on the SE. side, and a lighthouse on the north side.

Light.—On a circular pier near the northern end of Stannards Rock, a flashing white light, every 30 seconds, is shown from a conical, gray stone tower. It is visible in clear weather 16 ($18\frac{1}{2}$) miles.

Fog Signal.—From a house on the deck of this pier, a 10-inch steam whistle sounds a blast of 3 seconds, followed by a silent interval of 10 seconds, a blast of 5 seconds, followed by a silent interval of 42 seconds. This every minute during thick weather.

Beacon.—A granite beacon, 8 feet high and 9 feet in diameter at its base, with a wrought-iron shaft surmounting it, has been built 120 feet from the extreme south end, and 2,190 feet S. by E. $\frac{3}{4}$ E. (S. $19^{\circ} 41'$ E.) from the lighthouse.

Between Granite Point and Presqu' Ile the shore recedes, forming a shallow bight, clear of danger on the NW. side, but with rocks and shoals in the remaining portion, and with Middle Island as a prominent mark. To the east of Presqu' Ile is a large rock 20 feet in height, the most northerly of three, showing well above water. Between these rocks and the mainland is a narrow but good channel. Vessels bound to the southward should keep outside of these rocks, and not head down until the red light on the breakwater at Marquette is well open to the eastward of the main light.

Marquette.—This harbor is of the greatest importance, its commerce being extensive and constantly increasing, and it is also valuable as a harbor of refuge. In 1867 a breakwater was commenced, running out due south from a point just north of the city, and on the government reservation. It was practically completed in 1875, but since then the needs of commerce required its extension, and when finished it will be 3,000 feet in length. On account of the crowded condition of the harbor it was found necessary to put a line of snubbing posts on the harbor side of this breakwater. It now extends into over a 30-foot depth.

The neighborhood of Marquette is underlaid by vast beds of pure hematite.

Lights.—On the north part of the harbor, a fixed white light, visible $14\frac{1}{2}$ ($16\frac{3}{4}$) miles in clear weather, is exhibited from a square, yellow brick tower, rising from a dwelling, and a fixed red light is shown on the breakwater 300 feet from its south end. This light is visible $7\frac{1}{2}$ ($8\frac{1}{2}$) miles, and is shown from a square, brown skeleton, iron tower, with a cylindrical watchroom.

A fixed white lantern light has been established on the outer end of the extended breakwater. The light is 20 feet above lake level, and will be moved from time to time as the breakwater is extended. To be moved out about 1,000 feet on October 15, 1894.

Fog Signal.—Close to the lighthouse on the point, a 10-inch steam whistle gives a blast of 5 seconds, followed by a silent interval of 25 seconds.

Vessels should give the point a berth of at least $\frac{1}{2}$ mile to keep clear of dangers.

Life Saving Station.—There is a life saving station near the main light, at the north end of the breakwater.

Marquette to Grand Island.—Leaving Marquette steer E. $\frac{1}{4}$ N. (N. $87^{\circ} 11'$ E.) for 26 (30) miles, this should bring a vessel 3 ($3\frac{1}{4}$) miles west of Grand Island lighthouse, and with the range lights at head of harbor bearing S. by E. $\frac{1}{2}$ E. (S. $16^{\circ} 52'$ E.) See special directions for entering.

Marquette to St. Marys River.—Leaving Marquette steer E. by N. (N. $78^{\circ} 45'$ E.) for 52 (60) miles, passing 5 miles north of Grand Island light, until Point au Sable bears south 2 ($2\frac{1}{4}$) miles, thence steer E. $\frac{1}{4}$ N. (N. $84^{\circ} 22'$ E.) for 49 ($56\frac{1}{2}$) miles. This should bring a vessel 2 ($2\frac{1}{4}$) miles north of Whitefish Point, thence follow directions Portage Entry to St. Marys River.

From Marquette to Shot Point the trend is eastwardly, and off Shot Point a shoal makes out $\frac{1}{2}$ mile with 16 feet on it; from here on past Laughing Fish Point to Train Island there are no outlying dangers, but vessels should keep at least $\frac{1}{2}$ mile off shore.

Train Island lies in the NE. part of Shelter Bay; there is shoal water to the north and west of this island extending out $1\frac{3}{4}$ (2) miles, and also shoal water between it and the mainland. From the west point of Train Bay, a shoal extends to the northeastward about the same distance. In Train Bay vessels can find good anchorage from all winds, except those from the northward. Skirting the shore near Train Point is dangerous, and although there is a channel between Wood Island and Williams Island, it is well to keep to the northward of Wood Island, and between it and Grand Island if bound for Grand Island Harbor or South Bay. When near Williams Island, do not go to the westward of the range.

Lights.—Grand Island Harbor range consists of two lights. The front light, on the mainland and south shore of the west entrance, is a fixed white lens lantern, shown from a white frame tower and 23 feet above the lake level. About 375 feet S. by E. $\frac{1}{2}$ E. (S. $16^{\circ} 52'$ E.) from this front light is another of the same character shown from a square, white frame tower on a dwelling, and 41 feet above the lake level. Front light visible 10 ($11\frac{1}{2}$); rear light $11\frac{1}{4}$ ($13\frac{1}{2}$) miles.

Directions for Entering from the Westward.—Bring the lights or towers in range on a course S. by E. $\frac{1}{2}$ E. (S. $16^{\circ} 52'$ E.), continue this course until Powells Point opens well clear of the red spar buoy near Williams Landing, then head E. $\frac{1}{2}$ N. (N. $85^{\circ} 46'$ E.) until the harbor opens, when proceed to anchorage. One-fourth of a mile off shore gives plenty of water, except on the east side where a spit makes out with from 8 feet to 11 feet on it. If bound for South Bay, continue course E. $\frac{1}{2}$ N. (N. $85^{\circ} 46'$ E.) rounding Powells Point not nearer than $\frac{1}{4}$ mile. South Bay is entirely free from dangers $\frac{1}{4}$ mile off shore until in the region of Sand Point, when vessels should keep nearer to Grand Island.

Directions for Entering from the Eastward.—When $\frac{1}{4}$ mile off Castle Point, head SW. (S. 45° W.), this will bring Grand Island Harbor light a little on the starboard bow, and will lead clear of the shoals off Sand Point. If there is any set to the southward, haul up and head for the red spar buoy, until Sand Point is abeam, when a course can be shaped into South Bay. If bound for the harbor, continue the SW. (S. 45° W.) course until the village above Williams Landing is well open of the land forming the east side of the harbor.

Buoys.—A red spar buoy, 16 feet long, is on the south point of the 12-foot curve of Williams Landing shoal. Vessels should not pass between it and Grand Island.

A red spar buoy, 16 feet long, marks the extreme end of a shoal off Grand Island Harbor light. Vessels can run close to this buoy with safety, but should not pass between it and the lighthouse.

Light.—Grand Island Harbor light is a fixed white light visible $12\frac{1}{4}$ (14) miles, and is on the west side of the east entrance to the harbor. It is shown from a square, white frame tower.

To the northward from this light, Grand Island trends north, and when well clear of the entrance, vessels should not shut in the light on the island until well up with Trout Point, as a shoal of 12 feet makes out a good $\frac{1}{2}$ mile from shore. Trout Point should not be approached on the northward nearer than $\frac{3}{4}$ mile by vessels drawing over 12 feet. To the west of Trout Point lies Trout Bay, which is separated from Grand Island Harbor by a low strip of land $\frac{3}{4}$ mile wide. From here the coast stretches away to the northward, and on its extreme north point is Grand Island lighthouse.

Light.—A fixed white light, varied by a white flash every 90 seconds, visible $17\frac{1}{2}$ ($19\frac{1}{4}$) miles, and shown from a square, yellow brick tower rising from a dwelling.

Grand Island Harbor to St. Marys River.—Leave the harbor under special directions and steer NE. for Portal Point, keeping at least one mile off shore. When Portal Point bears south, distant a mile, steer NE. by E. (N. $56^{\circ} 15'$ E.) for 16 (18) miles, keeping at least 2 ($2\frac{1}{2}$) miles off shore until Point au Sable light bears south, distant 2 ($2\frac{1}{2}$) miles, change course to E. $\frac{1}{2}$ N. (N. $84^{\circ} 22'$ E.) for 49 ($56\frac{1}{2}$) miles, this should bring a vessel 2 ($2\frac{1}{2}$) miles north of Whitefish Point, when continue as previously directed under Portage Entry to St. Marys River.

Grand Island is surrounded by shoal water $\frac{1}{8}$ mile to $\frac{3}{4}$ mile off shore. It should be approached close-to with caution.

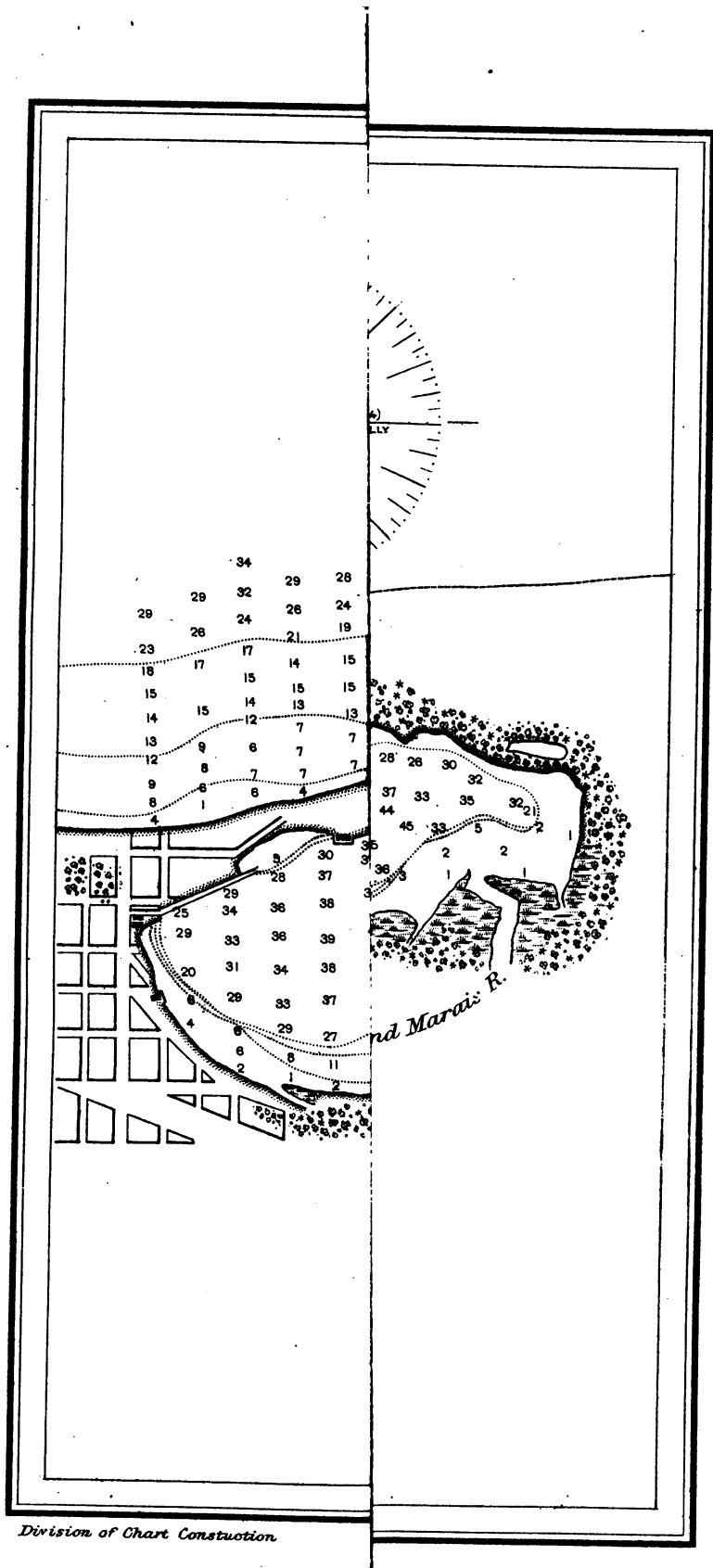
From Sand Point east, past Grand Portal to Point au Sable, the coast is free from dangers, Sail Rock one mile SW. and Chappel Rock one mile east from Grand Portal being close to shore. The determination of the coast lines by the wearing action of the waters upon the rocks of different degrees of hardness, is remarkably exemplified everywhere along the shore of Lake Superior, but nowhere more so than on this stretch of the coast. Here are precipitous cliffs of red sandstone which have been so carved by the waves as to have received the name of "Pictured Rocks." They stand opposite the greatest width of the lake and are exposed to the tremendous force of the heavy storms from the north. The effect of the waves is seen, not only in their irregular shapes, but the sand formed by the disintegration of the rocks is swept by the wind down the coast, and raised by the same force into long lines of sandy cliffs 100 feet high.

Off Point au Sable a shoal makes out $\frac{1}{2}$ mile to the northward.

Light.—On the point, a fixed white light, visible $16\frac{1}{2}$ ($18\frac{3}{4}$) miles, is shown from a conical white tower, connected with a red brick dwelling by a covered way.

To the east of this point, $7\frac{1}{2}$ ($8\frac{3}{4}$) miles, lies the entrance to

Grand Marias Harbor, Michigan.—Once within this harbor, there is ample depth to float the largest vessels, and as a harbor of refuge it is of the greatest importance to the shipping navigating the lake. The entrance to the harbor is to be 300 feet in width; protected on either



side by crib piers. The west pier is now 1,400 feet long, and the east pier 853 feet, and a channel of 175 feet in width, with a depth of 14 feet in the shoalest part, now exists. With any swell on, it will not be safe for a vessel drawing over 12 feet of water to attempt the entrance. It is hoped that both piers will be extended to a 20-foot depth of water, and that a harbor suitable for all vessels will be made.

From here on, the coast is clear of all dangers and can be approached to $\frac{1}{2}$ mile.

LIFE SAVING STATIONS.

Muskallonge Station is near the mouth of the Sucker River.

Two Heart River Station is near the mouth of the river of the same name.

Crisps Station, $15\frac{1}{2}$ (18) miles west of Whitefish Point.

Vermillion Point, $8\frac{3}{4}$ (10) miles west of Whitefish Point.

Whitefish Point is the turning point for vessels bound for the St. Marys River, and is the SW. point of Whitefish Bay.

Light.—A fixed white light, with a red flash every 20 seconds, visible $14\frac{1}{2}$ ($16\frac{1}{2}$) miles, is shown from a brown skeleton iron tower with a stair cylinder. It is connected with a white frame dwelling by a covered way.

Fog Signal.—A 10-inch steam whistle gives a blast of 5 seconds, followed by a silent interval of 13 seconds, then a blast of 2 seconds, followed by a silent interval of 40 seconds. This every minute during thick weather.

From Whitefish Point the coast makes a sudden change of direction to the southward as far as the mouth of the Taquamenon River.

A bay of very shallow water makes in here, and Taquamenon Island is 2 ($2\frac{1}{2}$) miles outside of a line joining the NW. and SE. points of this bay. All in shore of the island is shallow, with rocky bottom.

From the SE. point, and between it and Salt Point, are numerous rocks.

All of this coast, from Whitefish Point to Salt Point, should be approached with caution. From Salt Point to Iroquois Point the shore is more bold, but 2 ($2\frac{1}{2}$) miles west a little north from the latter point, a shoal makes out, and near its NW. end is Iroquois Island. Iroquois Point is the south side of the entrance to St. Marys River.

Light.—A flashing white light every 30 seconds is shown from this point. It is exhibited from a conical, white tower, connected with a dwelling by a covered way. Visible 14 ($16\frac{1}{2}$) miles.

Fog Signal.—A 10-inch steam whistle sounds a blast of 5 seconds, followed by a silent interval of 25 seconds.

CHAPTER II.

GENERAL DESCRIPTION OF NORTH SHORE AND ISLANDS IN LAKE SUPERIOR.

LAKE SUPERIOR, NORTH SHORE.

From Duluth north, the shore is rocky and bold with no dangerous reefs. Twenty miles from Duluth is the Knife River, and at its mouth, extending to the northeastward from Granite Point, is Isle aux Roches, known as Knife Island in this part of the country.

Isle aux Roches is joined to the mainland by a rocky reef; vessels bound for Knife River must round it to the northeastward. From here on to Agate Bay the shore can be approached close-to.

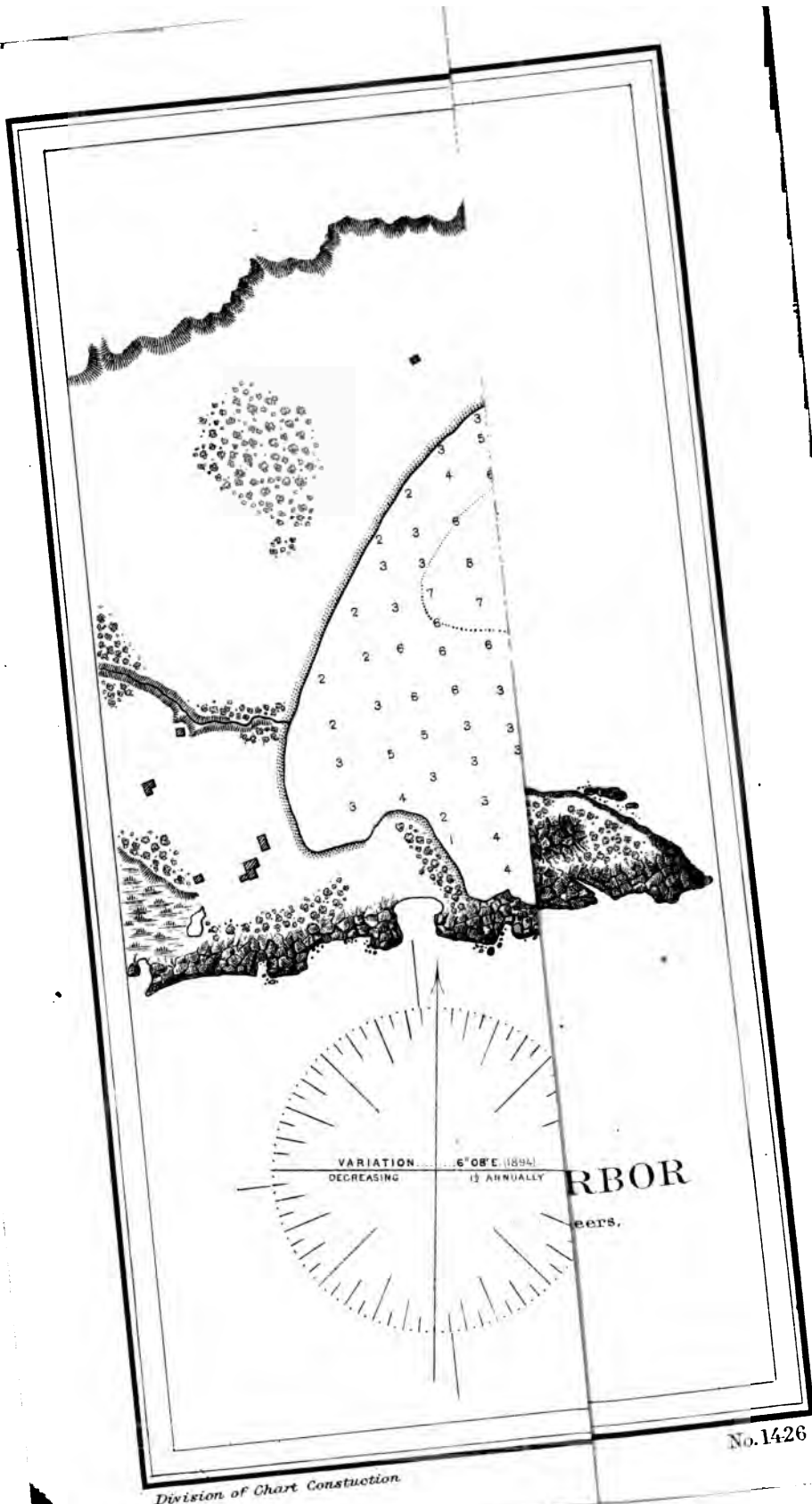
Agate Bay, Minnesota.—Agate Bay is a small indentation on the NW. shore of Lake Superior, $23\frac{1}{2}$ (27) miles from Duluth, and, although it has ample depth of water, it is neither protected naturally from the SW. nor from the reverse swell of the more dangerous storms of the NE. To protect shipping at the wharves, which would otherwise be greatly exposed, it is the intention to construct two breakwater piers on a line towards each other from the eastern and western points of the bay, 1,000 feet and 900 feet long respectively, leaving an opening of 1,340 feet between their extremities. There is not yet perfect security from the SW. storms for vessels lying at the docks, but it is no longer necessary to put to sea and seek security elsewhere.

On a point separating Agate Bay from Burlington is a

Light.—A fixed red light, visible $11\frac{1}{2}$ (13) miles in clear weather, is exhibited from a square red brick tower, rising from the SW. corner of a two-story red brick dwelling.

Fog Signal.—A 10-inch steam whistle giving blasts of 5 seconds duration, with alternate intervals of silence of 17 and 33 seconds, is sounded from a building 100 feet SW. from the lighthouse.

To the northward of this point lies Burlington Bay, and from here on the coast is bold and can be approached to $\frac{1}{2}$ mile. About $2\frac{3}{4}$ ($3\frac{1}{4}$) miles above this bay a rock lies close to shore, and $2\frac{1}{2}$ (3) miles from this rock lies Encampment Island. When within $\frac{1}{4}$ mile of Gooseberry River, a good lookout must be kept for a



Reef.—This dangerous reef lies $\frac{1}{2}$ mile from shore, is of small area, and has but $12\frac{1}{2}$ feet of water over it at the shoalest place. There is deep water all around it. It is a dangerous obstruction to vessels coasting the north shore of the lake.

Between Beaver Bay and Palisades are a few shoal spots close to shore.

To the northward from these reefs the coast is clear until Two Islands River is reached, off the mouth of which are two islands; from these on, the only outlying danger is Rock Island, $\frac{3}{4}$ mile off shore, and $1\frac{1}{4}$ ($1\frac{1}{2}$) miles E. by N. (N. $78^{\circ} 45'$ E.) from Terrace Point; $3\frac{1}{4}$ ($3\frac{3}{4}$) miles from Rock Island is

Grand Marais, Minnesota, which offers the only harbor of refuge during storms, between Agate Bay and Pigeon River, the international boundary line, a distance of 120 miles. It is the intention to build one pier 700 feet long from the east point, and dredge an anchorage to a depth of at least 16 feet. This will make an excellent harbor of refuge. The anchorage is compact in shape and fairly well protected.

Light.—On the outer end of the breakwater, a fixed white light, visible $11\frac{1}{2}$ ($13\frac{1}{4}$) miles in clear weather, is shown from a square, white, pyramidal, frame tower.

Fog Signal.—A bell, hanging in front of the tower, is struck by machinery, a double blow every 30 seconds.

From Grand Marais to the eastward, the shore continues bold, with the exception of a shoal ENE. $\frac{1}{8}$ E., (N. $68^{\circ} 54'$ E.) 5 miles from Grand Marais light. In Portage Bay it is shoal, and a shoal spot of 7 feet lies half way between Grand Portage Island and Hat Point. To the east of Wausaugoning Bay, many islands and shoals project from the mainland to the south, Lucille Island being the farthest off shore with a few rocks $\frac{1}{2}$ mile off its south point.

To Pigeon Point it is clear.

Pigeon Point forms the SE. point of Pigeon Bay. Through this bay, the boundary line, dividing the United States from Canada, runs to the mouth of Pigeon River. The south half of the Bay belongs to the United States, the north half with the islands, lying in the center of the Bay, to Canada.

CANADA.

From here on but little surveying has been done. All along this north shore the coast is bold and wild, rocky and bluff, presenting almost continuous ranges of cliffs, which vary in height from 300 to 1,500 feet, and rich in mineral wealth, native copper and silver being found. The only ore of lead met with in Canada is the sulphuret of galena. At Thunder Bay and in the Nipigon region to the north of Lake Superior, very numerous and valuable veins of ore are found. Innumerable small islands and rocks extend for a short distance from the shore. Cascades without

number can be seen falling down the steep cliffs, and the air is generally so clear that objects can be distinguished at a great distance. The caution must again be given not to approach this north shore too close until more accurate surveys have been made.

On account of the incomplete surveys, the outside course in making Thunder Cape will only be regarded until more complete information can be obtained. From Pigeon Point the land trends away to the westward, and along the coast are found Pigeon Bay, Pine River Bay, and Big Trout Bay. Two miles from the NE. point of the latter bay lies Victoria Island, sometimes known as Knob Island. There are a few islets and rocks lying off its east shore.

Light.—A fixed white light, visible 15 ($17\frac{1}{2}$) miles, is exhibited from a white, square, wood tower, with a red iron, lantern. This lighthouse is near the west side of the island.

Passing to the NE., Spar Island and Thompson Island are passed, with no outlying dangers, but between the two are many rocks, and a passage through should not be attempted.

Off the NE. end of Thompson island, a chain of small islands extends for a mile, and $1\frac{1}{2}$ miles further on are several groups of rocks awash.

Pie Island, the highest point of which is 950 feet above the lake level, should not be approached nearer than 2 miles. In entering Thunder Bay, it is preferable to keep well over to Thunder Cape (a mile off), when a course of NW. $\frac{1}{2}$ W. (N. $50^{\circ} 37' W.$) will carry clear of Hare Islet, and to the north of Welcome Islands on to the light on the break-water at Port Arthur.

Thunder Cape is an immense mass of trap, 1,300 feet high, and on its extreme SW. point is a lighthouse, from which is exhibited a light, and near the lighthouse is a fog signal station.

Light.—A revolving white light, attaining its greatest brilliancy every minute, and visible 12 ($13\frac{1}{4}$) miles in clear weather. It is shown from a square, white, wood tower, with a dwelling attached.

Fog Signal.—A steam horn sounds blasts of 5 seconds, followed by silent intervals of 25 seconds.

Thunder Bay is an extensive sheet of water, surrounded by grand scenery; all around it are cliffs rising from 1,000 to 1,500 feet out of the lake. It is 25 miles long by 16 miles wide.

The course, NW. $\frac{1}{2}$ W. (N. $50^{\circ} 37' W.$), carries clear of the Welcome Islands a good $\frac{1}{2}$ mile, and on passing these islands Fort William will open out into view.

Fort William is in a beautiful valley at the foot of Mount McKay, which rises 900 feet above the lake level. It is near the mouth of the Kaministiquia River, on its north branch. The mouth of this river forms a delta of three branches, the Big Fork or southern, the Little

Fork or center, and the main river or northern branch; all of these are navigable for small vessels, but it is on the north shore of the northern branch that the docks are situated. The channel through the slight bar that exists is indicated by six buoys, three on either hand, and on the mainland two range lights show the course at night.

Lights.—On the north shore of the river, just to the eastward of the Canadian Pacific Railway docks and elevators, is exhibited a fixed white light, visible 10 ($11\frac{1}{2}$) miles, and 879 feet ENE. from this one is a second fixed white light, visible 8 ($9\frac{1}{4}$) miles. These two lights in range lead through the dredged channel at the mouth of the river.

Inside, the mouth of the river is completely sheltered, and is from 300 to 400 feet wide, having, with the exception of two or three shallow places, a depth of from 15 to 25 feet for a distance of 4 miles; the bed is of stiff clay and is subject to no shifting sand bars.

There is also a signal mast near the range, the signals here made being the same as those shown at Port Arthur, from which place they are ordered.

A few miles further up the bay lies the town, formerly known as Port Arthurs Landing, but at the present time as

Port Arthur.—The harbor is an open one, the docks being protected by two breakwaters. Thirty-one feet from the southwestern end of the northern breakwater and serving as a guide to the passage between the two, is a light tower.

Light.—A fixed white light, visible 11 ($12\frac{2}{3}$) miles, is here exhibited from a white, square, wood tower.

Signal Mast.—The signal mast is on the Canadian Pacific Railway Dock, its position being $48^{\circ} 26' 05''$, N. and $89^{\circ} 12' 55''$ W. Elevation above the sea level 650 feet.

Harbor Master.—A harbor master is stationed here who has charge over all vessels calling at the port and who must be obeyed accordingly. Failure to comply with his orders subjects the person to penalties imposed by the Revised Statutes of Canada.

United States Representative.—There is a consular agent stationed at this port.

Thunder Cape to Whitefish Point.—E. by S. (S. $78^{\circ} 45'$ E.) 24 ($27\frac{3}{4}$) miles to abeam of Passage Island light, then SE. by E. $\frac{1}{4}$ E. (S. 59° E.) $165\frac{1}{2}$ ($190\frac{2}{3}$) miles.

Thunder Cape to Marquette.—SE. by E. $\frac{1}{4}$ E. (S. 79° E.) 24 ($27\frac{3}{4}$) miles, then SE. $\frac{3}{4}$ S. (S. $36^{\circ} 33'$ E.) $57\frac{1}{2}$ ($66\frac{1}{4}$) miles to Manitou light abeam, then S. $\frac{3}{4}$ E. (S. $8^{\circ} 26'$ E.) 53 (61) miles to entrance to harbor.

A little over 5 miles ENE. from Thunder Cape lies Silver Island, a patch of rock of small extent, but from which large quantities of silver have been taken.

Continuing the course to the eastward, the mouth of Black Bay is passed, in the middle of which lies a group of islets and rocks 3 miles NE. by N. and SW. by S. The east side of the mouth is shown by a light tower on Porphyry Point.

Light.—A fixed white light is here shown from a white, square, wood tower. It is visible 13 (15) miles.

Black Bay is 30 miles in depth from the light tower to the mouth of the Black River. The channel between the islets and Edward Island is clear of dangers, but the NW. end of this island should not be approached close-to, nor the small island just to the north. The point projecting to the SW. near The Paps has outlying rocks, and approaching Granite Islet care should be exercised. To the south of this islet it is clear, but there are rocks to the NE. from it. Except in mid-channel the water is generally shallow.

There are no important ports along this portion of the north shore, and the coast is indented with deep bays, of which Black Bay and Nipigon Bay are the largest. The rivers emptying into these bays teem with trout, and seem still to possess as many fish as when first discovered. Bears, deer, and occasional wolves may be killed, whilst there is a plentiful supply of feathered game.

Lamb Island is on the west side of the west entrance to Nipigon Bay, and on it is a light tower.

Light.—A fixed white light exhibited from a white, square, wood tower, with a dwelling attached. It is visible 15 (17½) miles.

This west entrance is 12½ miles long from the light tower to its outlet into the bay. It separates St. Ignace Island from the mainland.

Almost due east from the light, one mile, lies a dangerous rock.

Nipigon Bay, from the mouth of the Nipigon River to Salter Island, is 30 miles long east and west, and studded with numberless islands. St. Ignance and Simpson islands form the south shore.

The channel between Simpson and St. Ignace islands is clear, a few small islands lying in the fairway at the north end. The northern part of this channel is known as Moffat Harbor.

The channel running past the east shore of Simpson Island is wide bold, and free from dangers on a mid-channel course.

This east entrance is 4½ miles long, from the north end of Salter Island abeam to well clear of Battle Island light.

Caution.—Vessels using this channel are warned, when to the east of a line tangent to the west point of Salter Island and the west shore of the high bluff on the north shore, to watch for two shoal spots, one of 7 feet, ¾ mile NW. by N. (N. 33° 45' W.); the other of 6 feet, 1¼ (1½) mile N. by W. ¾ W. (N. 19° 41' W.) from the N.W. point of Salter Island.

Light.—On Battle Island an alternating red and white light is shown

from a white, square, wood tower. The light attains its greatest brilliancy every 30 seconds.

It is visible 16 ($18\frac{1}{2}$) miles in clear weather.

Directions.—If bound to Rossport, vessels can use the passage between Salter and Wilson islands. A mid-channel course of N. by W. $\frac{1}{4}$ W. (N. $19^{\circ} 41'$ W.) will carry through the passage and into the harbor. There is shoal water at the head of this harbor.

Running for Peninsula Harbor, keep the north shore distant 2 miles. Give the 9-foot shoal north of Slate Island a good berth. Passing Slate Island, keep to the south of Pic Island, and do not head to the northward of east until the light on the island, at the entrance to Peninsula Harbor, bears NE., when head for the light. It can be kept on either hand. Between Pic Island and the peninsula are many outlying rocks, 2 to 3 miles off shore.

Light.—A revolving white or bright catoptric light is here shown. The greatest brilliancy being obtained every 30 seconds. It is 105 feet above the lake level, and should be visible in clear weather 16 ($18\frac{1}{2}$) miles, from all points of approach by water.

The main building on the south end of the island opposite the peninsula at the entrance to the harbor, consists of a square, wooden tower, surmounted by an iron lantern, with a dwelling attached. The woodwork is painted white and the lantern red. The height of the building from its base to the vane on the lantern is 56 feet.

To the south from Peninsula Harbor, the coast trends to the southward for 40 miles to Otter Head, and from here it curves gradually to the east to the head of Michipicoten Harbor, about 57 miles. Bound to the southward, a course of S. by E. $\frac{1}{4}$ E. (S. $14^{\circ} 03'$ E.) from Peninsula light will carry 4 miles off Otter Head.

Otter Head to Gargantua Harbor.—SE. by E. (S. $57^{\circ} 15'$ E.) 57 ($65\frac{1}{2}$) miles will bring Gargantua light abeam.

Otter Head to Michipicoten Harbor.—SE. by E. (S. $57^{\circ} 15'$ E.) $22\frac{1}{2}$ (26) miles, then E. $\frac{1}{4}$ N. (N. $81^{\circ} 33'$ E.) to the harbor. When the change of course is made, the 850-foot peak should bear N. 45° E.

Otter Head to Quebec Harbor.—S. by E. $\frac{1}{4}$ E. (S. 14° E.) 20 (23) miles, when course should be gradually changed, keeping the shore 4 ($4\frac{1}{2}$) miles off, until the light at east entrance bears north, when head in for it. Quebec Harbor, *see* page 36.

Otter Head to St. Marys River.—S. by E. $\frac{1}{4}$ E. (S. $14^{\circ} 03'$ E.) 20 (23) miles, then SE. $\frac{1}{4}$ S. (S. $39^{\circ} 22'$ E.) 96 ($110\frac{1}{2}$) miles, will carry in.

At Michipicoten, a river of the same name empties into the bay. It is navigable up to the falls, a distance of 15 miles.

Gargantua Harbor is the next harbor of any importance on the Canadian side.

Light.—The tower stands on the summit of a small island in the mouth of the harbor, and is a wooden, hexagonal building, 43 feet high from the rock to the vane on the lantern, painted white, with the iron lantern surmounting it painted red.

The dwelling is located on the mainland on the north side of the harbor in a sheltered position.

The light is fixed white, elevated 97 feet above the level of the lake, and should be visible, from all points seawards, 15 ($17\frac{1}{2}$) miles. The illuminating apparatus is dioptric of small size.

South of Gargantua there are no ports until Bocheauaung Bay is reached. This bay is nearly land locked, a large island facing the west, separated by a narrow channel from the mainland on the north, and on the south by a passage of shoal water (8 feet) 2 miles wide. On Corbaye Point $3\frac{1}{4}$ ($3\frac{1}{2}$) miles west from this island is a light tower.

Light.—A fixed white light, visible 16 ($18\frac{1}{2}$) miles, is exhibited from a white, octagonal, wood tower, with dwelling attached.

Coast.—All the coast from Cape Gargantua, south, is lined with outlying dangers, and should be given a berth of at least 2 miles. The inshore passage between Leach, Lizard, Montreal Islands, and the mainland should not be used. (See p. 5 for reef.) Proceeding south from Coppermine Point, head over for Whitefish Point until certainly clear of Pancake Shoal, when course can be changed at will, the only other danger being half way between Sandy Island Group and Parisian Island, where there is a shoal of 8 feet.

If coming out of St. Marys river, and bound for the northward, Goulais Bay will afford good shelter, if caught in a northerly gale.

THE ISLANDS OF LAKE SUPERIOR.

Under this heading will be considered those islands in the lake which lie clear of the coast lines, and which cannot be regarded as forming bounds to any bays or harbors. Of these, there are: The Apostle Group, 19 in number; Isle Royale, Passage and Gull islands, Manitou Island, Huron Islands, and Granite Island in the waters of the United States. Slate and Pic islands, Michipicoten and Caribou, Leach, Lizard, Montreal, Sandy and Parisian islands, on the Canadian side.

UNITED STATES.

The Apostle Group is composed of 19 islands, stretching E. by N., 29 miles from the NW. point of Sand Island to the NE. point of Outer Island, and the same distance SW. $\frac{1}{2}$ S. from this latter point to the SW. point of Magdalene Island. Sand Island is the western; Devils Island the northern; Outer Island the northeastern, and Magdalene Island the southern. There are no important ports. There are several lighthouses

which are described in another portion of this work, pages 12 and 13. The passages through the group are generally clear of dangers, the shores bold and the water deep. The outlying spits are described, where necessary, under Dangers.

Anchorage.—Between Sand Island and Detour Station in 4 or 5 fathoms, protected from north winds and a partial breakwater afforded by the shoal connecting Sand Island with the mainland. The east side of Sand Island in 4 or 5 fathoms. Between Rocky and South Twin islands in 10 fathoms. The SE. coast of Stockton Island. A peninsula here projects $1\frac{1}{2}$ miles into the lake, having bays on both sides with from 4 to 10 fathoms. Under the NE. point of Cat Island in 4 fathoms. Outer Island affords anchorage on all sides, except near the SW. point. Magdalene Island; many good anchorages along the eastern coast, and at La Pointe, protection from NE. gales.

Isle Royale is $38\frac{1}{2}$ miles long NE. and SW., by $7\frac{1}{4}$ miles wide, the widest part. No important ports. Dangers described in first part of this work. There are many harbors along the coast. Grace and Washington Harbors and Rainbow Cove on the SW. end; Todd Harbor and McCargoe Cove on the west shore; Duncan Bay, Tobin and Rock harbors on the NE. end, and Chippewa Harbor and Siskiwit Bay on the east shore. Good anchorage can also be found between Wright Island and the main island, the NW. side of Siskiwit Bay. There is but one light, that is on Menagerie Island, NE. point of this same bay.

Light.—A fixed white light, visible $13\frac{1}{2}$ ($16\frac{1}{2}$) miles, is shown from an octagonal, white tower, connected by a covered way, with a dark brown stone dwelling.

Passage Island, $1\frac{1}{2}$ miles long, is 3 miles NE. from Blake Point, the northeastern point of Isle Royale. The shores are bold close-to. A small bay on the east side with $3\frac{1}{2}$ fathoms affords shelter.

Light.—On the SW. point of this island is a fixed red light, visible $11\frac{1}{2}$ (13) miles in clear weather. It is exhibited from an octagonal tower, rising from a dwelling, both built of gray stone.

Fog Signal.—In front of the lighthouse is a 10-inch steam whistle. During thick weather a blast of 5 seconds is sounded, each blast followed by a silent interval of 25 seconds.

Gull Islands, officially Isle Chapeau, 3 miles NE. from the above, a group of low lying rocks.

Manitou Island, $2\frac{1}{2}$ miles long by a mile wide, off Keweenaw Point. See page 16.

Huron Islands.—See page 22.

Granite Island.—See page 23.

CANADA.

On this side of the lake there are very few outlying islands.

Slate Islands are about the middle of the north coast line, the north point being 5 miles from the mainland. There are 8 islands of any noticeable size, the largest being $3\frac{1}{2}$ miles north and south by $4\frac{1}{2}$ miles east and west. There are numbers of outlying rocks.

Pic Island, 760 feet high, $9\frac{1}{2}$ miles west of the peninsula, is of an irregular shape, bold with deep water, and small islands off the NE. and south coasts.

Michipicoten Island is the largest of the Canadian islands, being $15\frac{1}{2}$ miles long by 6 wide. The shores should be approached cautiously on account of outlying dangers.

Quebec Harbor is about the middle of the south coast. On a headland, the east point of entrance to this harbor, is a

Light.—A fixed white light, visible 15 ($17\frac{1}{4}$) miles, is exhibited from a white, square, wooden tower.

Fog Signal.—A bell rung by machinery.

Caribou Island is 19 miles south from Quebec Harbor. This island is dangerous all round. On account of its position a light tower is here erected and from it is shown a

Light.—A revolving white light, attaining its greatest brilliancy every 10 seconds, and visible 15 ($17\frac{1}{4}$) miles. It is not on the island proper but on a very small island a little SW. from it. The tower, white, octagonal in shape, built of wood, with a dwelling attached. The lantern is painted red. 100 feet south of the light tower is a

Fog Signal.—A steam horn sounds a blast of 5 seconds, followed by a silent interval of 25 seconds, during thick weather.

Leach Island, *see* page 5.

Lizard Island, *see* page 5.

Montreal Island, *see* page 5.

Reef, *see* page 5.

Sandy Island, *see* page 5.

Parisian Island, *see* page 5.

CHAPTER III.

ST. MARYS RIVER* AND DETOUR PASSAGE.

ST. MARYS RIVER.

This river forms the connecting link between lakes Superior and Huron. At Sault Sainte Marie, navigation in the early days was interrupted by the rapids, the river here descending 22 feet in a distance of $\frac{3}{4}$ mile.

Through this river runs the boundary line between the United States and Canada; all the larger islands in the river belong to the United States, excepting St. Joseph and Squirrel islands, which belong to Canada.

From abreast of Point Iroquois on the Lake Superior end to Point Detour on Lake Huron is $71\frac{1}{2}$ ($82\frac{1}{2}$) miles. The only places of any importance are the towns of Sault Sainte Marie, situated on either side of the river at the rapids. To facilitate navigation at this point, a canal was dug on the United States side.

This canal is a little over a mile in length, with a bottom width of 100 feet, and has one lock, the dimensions being: length 515 feet; width 80 feet; gate openings 60 feet wide, with 16 feet of water on the sills, and a lift of about 18 feet.

It is the intention to enlarge this canal and the dimensions of the new lock will be: length 800 feet between gates, width 100 feet throughout, with 21 feet of water on sills, with a single lift, approximating 18 feet. In connection with this enlargement, it is proposed to make a channel 300 feet wide and of a navigable depth of 20 feet in the southern channel below the falls, known as the Hay Lake Channel. This improved route will leave the present channel of the river at Sugar Island Rapids about $2\frac{1}{2}$ miles below the canal; will pass through these into Hay Lake; then by way of Middle Neebish, rejoining the present channel at the foot of Sugar

*The following channels are to be excavated:

1. A channel 21 feet deep and 300 feet wide at Round Island Shoals, St. Marys River.
2. A channel 21 feet deep and 300 feet wide in Little Mud Lake, St. Marys River, between the lower end of Sugar Island and the lower end of the "Dark Hole."
3. A channel 21 feet deep and 300 feet wide through a reef in St. Marys River abreast of Sailors Encampment Island.
4. A channel 21 feet deep and 300 feet wide through a shoal in Mud Lake, St. Marys River, $1\frac{1}{2}$ miles below Sailors Encampment Island.

Island, saving a distance of 11 miles and giving a route which can be easily marked by lights so as to be navigable by night.

DISTANCES BY THE HAY LAKE CHANNEL.

	Miles.
Detour Light to Anthonys Dock.....	2½
Anthonys Dock to Lime Island Dock.....	9
Lime Island Dock to can buoy, Mud Lake.....	10
Can buoy to Johnson Point, Rains Island.....	4
Johnson Point to intersection Hay Lake Channel....	4½
Intersection of channel to Rains Dock, Sugar Island..	1½
Rains Dock to head of cut, Lake George.....	7
Head of cut (or flats) to Churchs Point.....	6
Churchs Point to intersection of Hay Lake Channel..	11
Intersection of channel to lower lock gates.....	2
Lower lock gates to abreast Point Iroquois.....	15
Total.....	72½

From the point where Hay Lake Channel leaves the old Channel to where it rejoins it, the distance is but 15½ miles, while by the old channel it is 25½ miles. The distances here given are in statute miles.

On the Canadian side a canal is being cut through St. Marys Island, on the north side of the rapids of the St. Marys River, in length, with its approaches, about 18,100 feet. The canal proper will have a length across the island of 3,500 feet, a width at low-water level of 152 feet, and a bottom width of 145 feet, with a navigable depth at extreme low-water level of 20 feet.

The lock will be: length of chamber 900 feet; width of chamber 60 feet; gate width 60 feet; depth of the canal prism 22 feet below the lowest recorded river level.

The masonry walls will extend 1,106 feet on each side. There are to be three sets of gates at the eastern or lower end; one is a guard gate to be used only when wishing to empty the lock for repairs. Of the other two gates, one is a spare set to be used in case of accident to the outer gate, this latter being in constant use. At the west end there will be a main gate and a guard gate. The width of the walls is 11 feet at the top and 20 feet at the bottom, with a uniform width around the gates of 25 feet for the entire height.

There are two faults found with this canal: First, the span for the new bridge near the entrance to the lock is too narrow as compared with that in the United States Canal, this latter draw being 200 feet in width, while the Canadian draw is but 90 feet wide, with the additional danger of a square, stone abutment in the center of the canal. Second, the uneven character of the stonework at the entrance to the lock, the projecting rocks preventing the use of fenders.

To further increase the efficiency of the river for purposes of navigation, a system of lights was adopted by the Governments of the United States and Canada, 8 Canadian lights being put in operation simultaneously with 38 United States lights; 3 additional lights were afterward established by the United States. This system fulfills its purposes admirably, permitting free navigation at night, and being of especial benefit to heavy draft steamers.

LIGHTS AND RANGES IN ST. MARYS RIVER IN CONNECTION WITH DIRECTIONS FROM WEST TO EAST.

ST. MARYS RIVER RANGE, UPPER.

Two fixed white lights on the mainland, Michigan, one mile ESE. from Round Island.

The front light is shown from a square, white, frame tower, 21 feet above the lake level, and visible $9\frac{1}{2}$ (11) miles.

The rear light is shown from a square, white, pyramidal frame tower, 1,180 feet SE. by E. $\frac{1}{2}$ E. (S. $61^{\circ} 52'$ E.) from the preceding; it is 36 feet above the lake level, and visible $11\frac{1}{4}$ (13) miles.

These lights lead through the cut between Round Island and Point Iroquois.

ST. MARYS RIVER RANGE, LOWER.

Two fixed red lights on the mainland, Michigan, nearly opposite Pointe aux Pins light station, Canada.

The front light is shown from a square, white, frame tower, 18 feet above the lake level, and is visible $7\frac{1}{2}$ ($8\frac{1}{2}$) miles.

The rear light, 1,430 feet ENE. $\frac{1}{2}$ E. (N. $73^{\circ} 7'$ E.) from the preceding, is shown from a square, white, pyramidal frame tower, 33 feet above the lake level, and is visible $8\frac{1}{2}$ ($9\frac{1}{4}$) miles.

These guide through the cut between Round Island and Pointe aux Pins light station.

POINTE AUX PINS LIGHT.

A fixed white light, shown from a white, square, wood lighthouse, on outer end of a low sand point, on the Canadian shore. It is 30 feet above high water, and visible 8 ($9\frac{1}{4}$) miles.

FOOTES DOCK LIGHT.

A fixed red light, shown from a mast, at the shore end of the dock, on the Canadian bank of the river. It is 24 feet above high water, and is visible 5 ($5\frac{1}{4}$) miles. It serves as a beacon light, showing up and down the river.

ST. MARYS FALLS CANAL, SOUTH PIER.

A fixed red light, shown from a conical, white, iron tower, on the outer

end of the south pier, at western entrance to St. Marys Falls Canal, Michigan. It is 30 feet above the lake level, and visible $10\frac{1}{2}$ ($12\frac{1}{2}$) miles.

ST. MARYS FALLS CANAL, NORTH PIER.

A fixed white light, varied by a flash every minute, shown from a triangular, pyramidal, open frame work, iron tower; the upper half slatted and painted white; lower half open and painted brown. It is 450 feet from the outer end of the north pier at west entrance of canal, 57 feet above the lake level, and visible $7\frac{1}{4}$ ($8\frac{1}{2}$) miles.

BAYFIELD ROCK RANGE.

Two fixed white lights on the NW. end of Sugar Island, Michigan.

The front light is shown from a wooden upright, 24 feet above the lake level.

The rear light, 945 feet ESE. $\frac{3}{4}$ E. ($S. 71^{\circ} 43' E.$) from the preceding, is also shown from a wooden upright, 34 feet above the lake level.

This range, WNW. $\frac{3}{4}$ W. ($N. 71^{\circ} 43' W.$), guides from the lower entrance of St. Marys Falls Canal, past Bayfield Rock to its intersection with the Sault Range, near Topsail Island.

SAULT RANGE.

Two fixed red lights, one mile easterly from the city of Sault Sainte Marie, Michigan.

The front light, 160 feet from shore, is shown from a wooden upright 21 feet above the lake level.

The rear light, 535 feet W. by S. ($S. 78^{\circ} 45' W.$) from the preceding, is also shown from a wooden upright, 37 feet above the lake level.

This range astern guides from the intersection with Bayfield Rock Range, E. by N. ($N. 78^{\circ} 45' E.$), to its intersection with Topsail Island Range.

TOPSAIL ISLAND RANGE.

Two fixed red lights on the NW. side of Sugar Island.

The front light is near the shore, is shown from a wooden upright, and is 40 feet above the lake level.

The rear light 525 feet E. $\frac{1}{2}$ N. ($N. 84^{\circ} 22' E.$) from the preceding, is also shown from a wooden upright.

This range leads clear of Marchand and Jenkins Rock Buoys, and carries E. $\frac{1}{2}$ N. ($N. 84^{\circ} 22' E.$) to its intersection with Farmers Ridge Range.

N. B.—The front light of Topsail Island Range is also the rear light of Partridge Point Range.

FARMERS RIDGE RANGE.

Two fixed red lights on the NW. side of Sugar Island and between Brusants Point and Point Lewis.

The front light is on the edge of the shore and shown from a wooden upright, 22 feet above the lake level.

The rear light, also shown from a wooden upright, is 734 feet NE. by E. (N. $56^{\circ} 15'$ E.) from the preceding, and is 57 feet above the lake level.

This range guides through the Farmers Ridge Passage.

PARTRIDGE POINT RANGE.

Two fixed red lights on the NW. side of Sugar Island, Michigan.

The front light is on the edge of the shore, exhibited from a wooden upright, at a height of 29 feet above the lake level.

The rear light is near the shore, 600 feet S. by W. $\frac{3}{4}$ W. (S. $18^{\circ} 16'$ W.) from the preceding, exhibited from a wooden upright, and is 40 feet above the lake level.

These two lights in range guide from the intersection with Farmers Ridge Range to the turning point abreast Brusants Point.

N. B.—The rear light of this range is also the front light of the Topsail Island Range.

PALMERS POINT LIGHT.

Is in the water, at the edge of the channel off Palmers Point, the north end of Sugar Island, and at the west side of Little Lake George.

It is a fixed white light, with a red sector on each side.

The north edge of the east red sector cuts Palmers Point Buoy, (black No. 55), the first black buoy east of Palmers Point.

The north edge of the west red sector cuts Pointe aux Pins Buoy, (black No. 57), the first black buoy west of Palmers Point.

It is exhibited from a white upright, rising from a small white house with a red roof, and built on a crib. It is 28 feet above the lake level.

CATHOLIC MISSION RANGE.

Two fixed white lights, exhibited from wooden uprights on the north end of Sugar Island.

The front light is on the south shore of Little Lake George, 24 feet above the lake level.

The rear light is 810 feet SE. $\frac{1}{2}$ E. (S. $50^{\circ} 37'$ E.) from the front light, 40 feet above the lake level.

These two lights in range guide from between the buoys off Palmers Point to the intersection with the Payment Range, leading through the western reach of Little Lake George.

PAYMENT RANGE.

Two fixed red lights, shown from wooden uprights on the north end of Sugar Island.

The front light, 22 feet above the lake level, is on the south shore of Little Lake George.

The rear light, $29\frac{1}{2}$ feet above the lake level, is 756 feet WSW. $\frac{1}{4}$ W. (S. $73^{\circ} 07' W.$) from the front light.

These lights in line lead through the west reach of Little Lake George from the intersection with the Catholic Mission Range, until near Payment Docks.

MANHATTAN SHOAL LIGHT.

On a 10-foot shoal off the NE. end of Sugar Island.

It is a fixed white light between two red sectors.

The west sector marks the point for change of course on making Garden River Reach.

The south sector marks the turn to the eastward in the bend off the west point of Squirrel Island.

It is shown from a white upright, rising from a small white house with a red roof, and is built on a crib. It is 28 feet above the lake level.

CHURCH POINT LIGHT.

In 16 feet of water, off the SE. extremity of a shoal making off into Lake George, from Churchville Point, Michigan.

A fixed white light, 28 feet above the lake level, is exhibited from a white upright, rising from a small white house with a red roof, built on a crib.

It marks the south end of the passage between Sugar Island and Squirrel Island. It must be left to the westward.

CHURCHVILLE POINT LIGHT.

On Churchville Point, the east point of Sugar Island.

A fixed white light, with two fixed red sectors, is exhibited at an elevation of 30 feet, from a post on the center of a square white lamp house.

The southerly red sector covers black spar buoy, No. 49, and marks the turning point to and from the channel between Squirrel Island and Church Point. The northerly red sector cuts the southerly red sector of Manhattan Shoal light and marks the turn of channel midway in the bend.

UPPER LAKE GEORGE LIGHT.

In 12 feet of water, about 50 feet from the east side of the upper end of the dredged channel.

A fixed red light, 28 feet above the lake level, shown from a white upright, rising from a white house with a red roof, built on a crib.

It marks the north entrance to the main channel of Lake George.

MIDDLE LAKE GEORGE LIGHT.

In 5 feet of water, 50 feet from the east side of the dredged channel at the elbow.

A fixed red light, $31\frac{1}{2}$ feet above the lake level, shown from a square buff dwelling, with a red mansard roof, surmounted by a black lantern.

It is built on a crib.

It marks the elbow in the main channel of Lake George.

LOWER LAKE GEORGE LIGHT.

In 10 feet of water, 50 feet from the east side of the south end of the dredged channel.

A fixed white light, 28 feet above the lake level, shown from a white upright, rising from a small white house with a red roof, built on a crib

It marks the south entrance to the main channel of Lake George.

DUCK ISLAND RANGE.

Two fixed red lights near the south end of Duck Island on wooden uprights.

The front light is near the water's edge on the channel side of the south end of Duck Island above East Neebish, Michigan. It is $22\frac{1}{2}$ feet above the lake level.

The rear light is 663 feet S. $\frac{1}{2}$ E. (S. $5^{\circ} 37'$ E.) from the preceding, and $34\frac{1}{2}$ feet above the lake level.

EAST NEEBISH RANGE.

This range comprises lights on the United States and Canadian shores.

Two fixed red lights on the east side of Sugar Island at the foot of East Neebish, Michigan, form the United States Range.

The front light is 24 feet above the lake level, and is shown from a wooden upright.

The rear light is 283 feet S. $\frac{1}{8}$ W. (S. $1^{\circ} 24'$ W.) from the preceding, and $37\frac{1}{2}$ feet above the lake level.

These two lights in one, S. $\frac{1}{8}$ W. (S. $1^{\circ} 24'$ W.) form the same alignment as the Canadian East Neebish Range, and are intended to guide vessels going up or down the river through the upper reach of East Neebish.

EAST NEEBISH RANGE (CANADIAN).

Two fixed red lantern lights, shown from the masts on the east or Canadian shore of St. Marys River, $\frac{1}{2}$ mile above Ned and Indian Points, and one mile below Birch Point. Both lights should be visible 2 miles in, and over a small arc on each side of, the alignment.

The front mast stands 159 feet back from the shore in the line of range,

and is 17 feet high. The light is elevated 34 feet above the level of the river.

The back mast stands 302 feet N. $\frac{1}{2}$ E. (N. $1^{\circ} 24' E.$) from the front one. It is 22 feet high, and the light is 42 feet above the water.

The two lights in one, N. $\frac{1}{2}$ E. (N. $1^{\circ} 24' E.$), form the same alignment as the United States East Neebish Range, and are intended to guide vessels going up the river through the upper reach of East Neebish, from the intersection of the alignment with Indian Point (United States) Range till abreast of Indian Point, when a NNW. (N. $22^{\circ} 30' W.$) course will lead up the middle of the river clear of all obstructions to the intersection with Duck Island (United States) Range.

INDIAN POINT RANGE.

Two fixed white lights on the east side of Sugar Island, Michigan, exhibited from wooden uprights.

The front light, 23 feet above the lake level, is south of Indian Point.

The rear light, 34 feet above the lake level, is 274 feet NNW. $\frac{1}{4}$ W. (N. $30^{\circ} 56' W.$) from the preceding.

This range guides through the lower reach of East Neebish from the intersection with the East Neebish Range to a point 300 yards above Rains Wharf.

HEN AND CHICKENS RANGE.

Two fixed red lights on the United States side, shown from wooden uprights.

The front light is on the most easterly of a small group of islands, called the Hen and Chickens, off the NE. shore of Neebish Island.

It is 22 feet above the lake level.

The rear light is on the NE. shore of Neebish Island 1,700 feet SW. $\frac{1}{2}$ W. (S. $50^{\circ} 37' W.$) from the preceding.

The range guides through the passage between St. Joseph and Sugar islands from Harwood Point Buoy (black No. 17) to Stribling Point Buoy (red No. 12), the intersection with the Harwood Point Range.

HARWOOD POINT RANGE.

Two fixed white lights on wooden uprights at Harwood Point, SE. end of Sugar Island.

The front light is 22 feet above the lake level.

The rear light is 725 feet N. $\frac{1}{2}$ W. (N. $5^{\circ} 37' W.$) from the preceding.

This range guides from the intersection with the Hen and Chickens, near Stribling Point Buoy (red No. 12) to the intersection with Dark Hole West Range near Mud Lake Buoy (black No. 13).

DARK HOLE WEST RANGE.

Two fixed white lights shown from wooden uprights on north point of Sailors Encampment or Rains Island.

The front light is $23\frac{1}{2}$ feet above the lake level.

The rear light is 51 feet above the lake level and 750 feet S. $\frac{1}{4}$ E. (S. $2^{\circ} 48'$ E.) from the preceding.

This range, in alignment with Harwood Point Range, carries between the buoys off Point of Woods, the intersection with Dark Hole East Range.

DARK HOLE EAST RANGE.

Two fixed red lights on the NE. side of the north end of Sailors Encampment or Rains Island, and shown from wooden uprights.

The front light is near the edge of the shore and 17 feet above the lake level.

The rear light is 231 feet S. by E. (S. $11^{\circ} 15'$ E.) from the preceding and 45 feet above the lake level.

This range guides, on a course S. by E. (S. $11^{\circ} 15'$ E.), from the intersection with Dark Hole West Range to its intersection with Point of Woods Range.

POINT OF WOODS RANGE.

Two fixed red lights on the east side of Neebish Island, shown from wooden uprights.

The front light is $14\frac{1}{2}$ feet above the lake level and near the edge of the shore.

The rear light is 44 feet above the lake level and 296 feet NW. $\frac{1}{2}$ W. (N. $50^{\circ} 37'$ W.) from the front light.

These lights in range from the intersection with Dark Hole East Range lead through the Dark Hole Passage and are in the same alignment as Rains Wharf Range on the Canadian side.

RAINS WHARF RANGE (CANADIAN).

Two fixed red lantern lights, shown from the masts at William Rains Wharf on the west shore of St. Joseph Island, opposite Johnson Point, and between the two Sailors Encampment Ranges. These lights should be visible 2 miles in, and over a small arc on each side of, the alignment.

The front mast, 17 feet high, stands near the outer end of the wharf. The light is elevated 15 feet above the level of the river.

The back mast stands 390 feet SE. from the front one. It is 22 feet high. The light is 24 feet above the level of the river.

This Range is in the same alignment as the Point of Woods (United States) Range, and is intended to guide vessels going down stream through the Dark Hole Passage, SE. $\frac{1}{2}$ E. (S. $50^{\circ} 37'$ E.), from its intersection with the alignment of the United States East Range, Dark Hole, to its intersection with the Sailors Encampment Ranges.

SAILORS ENCAMPMENT LOWER RANGE (CANADIAN).

Two fixed red lantern lights, shown from masts on the west shore of St. Josephs Island, $\frac{1}{2}$ mile below Ross wharf. Both lights should be visible 2 miles in, and over a small arc on each side of, the alignment.

The front mast stands on the shore line, and is 17 feet high. The light is elevated 19 feet above the level of the river.

The back mast stands 64 feet east from the shore line, and is distant 246 feet S. $\frac{1}{8}$ W. (S. $9^{\circ} 50'$ W.) from the front one. It is 22 feet high, and the light is elevated 26 feet above the water.

The two lights in one, S. $\frac{1}{8}$ W. (S. $9^{\circ} 50'$ W.), guide vessels down the river past the turn at Johnson Point. The range should be kept from its intersection with Rains Wharf Range till the Encampment (United States) Crib Light is passed, when the alignment should be left on the port hand.

SAILORS ENCAMPMENT UPPER RANGE (CANADIAN).

Two fixed red lantern lights, shown from the masts near the west shore of St. Joseph Island, $\frac{1}{2}$ mile below Reed Point. Both lights should be visible 2 miles in, and over a small arc on each side of, the alignment.

The front mast stands on rising ground, 640 feet from the shore of the river in the alignment, and is 17 feet high. The light is elevated 65 feet above the level of the river.

The back mast, 22 feet high, is 260 feet N. $\frac{1}{8}$ E. (N. $9^{\circ} 50'$ E.) from the front one. The light is 73 feet above the water.

The two lights in one N. $\frac{1}{8}$ E. (N. $9^{\circ} 50'$ E.), guide vessels going up the river past the turn at Johnson Point. The alignment should be taken as soon as the Encampment Crib (United States) light is abeam, and kept until the Point of Woods (United States) Range lights are brought into alignment.

This range and the Sailors Encampment Lower Range, above described, are in the same alignment.

ENCAMPMENT CRIB LIGHT.

A fixed red light, 28 feet above the lake level, shown from a white upright, rising from a small white house with a red roof, built on a crib in 8 feet of water, off the SE. side of Sailors Encampment Island.

It marks a shoal and the west side of the South entrance to Sailors Encampment Passage.

WINTER POINT RANGE.

Two fixed white lights at Winter Point, the southerly end of Neebish Island (St. Tammany is the official name of this island).

The front light is shown from the keeper's dwelling, 32 feet above the lake level.

The rear light is on Winter Point 150 feet NW. $\frac{1}{8}$ W. (N. $49^{\circ} 13'$ W.) from the front light. It is 68 feet above the lake level and is shown from

a skeleton iron tower, with black day mark. The keeper's dwelling is white with a red roof, and is on the range line 135 feet from the tower.

These lights in range astern guide from the black and white perpendicular striped (Mud Lake Turning) buoy to the southeastward.

ROUND ISLAND LIGHT

Is on the east side of Round Island and shown from a square wooden tower in front of a one-and-one-half-story frame dwelling. This house is painted buff with white trimmings, and the lantern black.

The light is a fixed white light, visible 4 miles, with two red sectors. It shows white from N. 1° E. to S. 1° W. to the east, and red over the remaining 180 degrees where not obscured by the land.

Keeping to the eastward of the lines of demarcation carries clear of the shoals off the south of Round Island, and to the north the line marks the turning point, at its intersection with the Winter Point Range line.

SWEETS POINT LIGHT.

A fixed white light shown from a white upright rising from a small white house with a red roof, built on a crib.

This crib is in 7 feet of water, off Sweets Point, $2\frac{1}{4}$ miles NW. $\frac{1}{4}$ W. (N. $54^{\circ} 50'$ W.) from Pipe Island light. Visible about 7 miles.

It marks the turning point in the channel.

PIPE ISLAND LIGHT.

A fixed red light, visible $8\frac{1}{2}$ ($9\frac{1}{4}$) miles, on the SW. side of Pipe Island. It is exhibited from an octagonal, white tower, surmounted by a black lantern; a detached white frame dwelling one and one-half stories high stands about 50 feet from the tower. The light is $37\frac{1}{2}$ feet above the lake level and marks the east side of the channel between Pipe Island and the mainland.

FRYING PAN ISLAND LIGHT.

A fixed red light, visible $7\frac{1}{2}$ ($8\frac{1}{2}$) miles, on Frying Pan Island.

It is $18\frac{1}{2}$ feet above the lake level, and is shown from a conical, white, iron tower.

It marks the west side of Detour Passage and is 2 miles from Detour light.

DETOUR LIGHT.

A fixed white light, visible $14\frac{1}{4}$ ($16\frac{1}{2}$) miles, is shown from a white, skeleton, iron tower with a stair cylinder. The tower is connected with a white frame dwelling by a covered way.

It marks the west side of the entrance to the St. Marys River.

There is a fog signal building 50 feet east of the light. A 10-inch steam whistle gives a blast of 8 seconds duration followed by a silent interval of 52 seconds.

For a description of the buoys used in the St. Marys River as aids to navigation, see "List of Beacons, Buoys and Daymarks," published by the U. S. Lighthouse Board.

DIRECTIONS WEST TO EAST.

Standing in from Lake Superior bring Point Iroquois light abeam, distant one mile,

head a course SE. $\frac{1}{2}$ S. (S. $39^{\circ} 22'$ E.)
 until St. Marys River Upper Range comes on, then
 head a course, on the range, SE. by E. $\frac{1}{2}$ E. (S. $61^{\circ} 52'$ E.)
 until St. Marys River Lower Range is made, then
 head a course, on the range, ENE. $\frac{1}{2}$ E. (N. 74° E.)
 until Pointe aux Pins light bears N. by E. $\frac{1}{2}$ E. (N. $16^{\circ} 52'$ E.) then
 head a course NE. $\frac{1}{4}$ N. (N. $36^{\circ} 30'$ E.)
 until Pointe aux Pins bears abeam, then
 head a course NE. by E. (N. $56^{\circ} 15'$ E.)
 until Big Point bears south, when a
 course E. by N. (N. $78^{\circ} 45'$ E.)

will lead in for the lights at the west entrance of St. Marys Falls Canal. This course will carry clear of the 11-foot shoal $1\frac{1}{2}$ miles W. $\frac{1}{2}$ S. from the North Pier light and to the south of Vidal Shoal.

Passing through the canal the channel beyond is marked by many buoys, visible the one from the other, excepting the bend at Garden River Reach around the NE. point of Sugar Island; here it is best to keep the Canadian shore close-to.

Clearing the east entrance of the canal

head a course ESE. $\frac{3}{8}$ E. (S. $71^{\circ} 43'$ E.)
 on Bayfield Rock Range until the Sault Range is made, when bring it in line astern and

head a course on the range E. by N. (N. $78^{\circ} 45'$ E.).

When near the spar buoy off Jenkins Rock

head a course E. $\frac{1}{2}$ N. (N. $84^{\circ} 22'$ E.)
 on the Topsail Island Range until the Farmers Ridge Range lights come in line, when a

course on the range, NE. by E. (N. $56^{\circ} 15'$ E.)
 must be made until Partridge Point Range lights can be brought in line astern, when

head a course, on the range, N. by E. $\frac{3}{8}$ E. (N. $18^{\circ} 16'$ E.).

Continue this course until Point Lewis is abeam, then make a

course NNE. $\frac{1}{4}$ E. (N. $30^{\circ} 56'$ E.),

keeping in mid-channel past Patridge Point. On nearing Bells Point take a mid-channel course past it and Palmers Point, passing Palmers Point light near-to on a

course ESE. $\frac{3}{4}$ E. (S. $75^{\circ} 56'$ E.)

until close to buoys, when head on the Catholic Mission Range a

course SE. $\frac{1}{2}$ E. (S. $50^{\circ} 37'$ E.)

until Payment Range can be made astern, when

head a course, on the range, ENE. $\frac{1}{2}$ E. (N. $73^{\circ} 07'$ E.)

until close to Payment Docks, thence a channel course must be carried, nearer the Canadian shore, rounding the point and passing between the red spar buoy and Manhattan light.

From this light a mid-channel course between Squirrel Island and St. George (Sugar) Island, until abeam of Church Point, when a

course S. by E. $\frac{1}{2}$ E. (S. $16^{\circ} 52'$ E.)

will carry clear of Church Point light. Pass the black buoy, which marks the turning point to the south, on the starboard hand, then

head a course SSW. $\frac{1}{8}$ W. (S. $23^{\circ} 54'$ W.)

to Upper Lake George Crib light, keeping it to port,

shape a course S. by E. $\frac{1}{4}$ E. (S. $14^{\circ} 03'$ E.)

through the cut, passing between the buoys, of which there are 11 pairs, as far as Middle Lake George light, then between the buoys in mid-channel to the lower light. From the lower light

a course S. $\frac{1}{2}$ E. (S. $5^{\circ} 37'$ E.)

will carry abeam of the red spar buoy off Duck Island.

Keeping this buoy to port, head

a course SSE. (S. $22^{\circ} 30'$ E.)

until between Indian Point and Ned Point. Here the East Neebish Range should be taken

on a course, on the range, S. $\frac{1}{8}$ W. (S. $1^{\circ} 24'$ W.),

the United States lights ahead, the Canadian lights astern.

Carry this course until on Indian Point Range, when a

course, on the range, SSE. $\frac{1}{2}$ E. (S. $28^{\circ} 07'$ E.)

for a distance of $1\frac{1}{4}$ (2) miles will bring close to the buoys off Harwood Point. Round the black buoys, when

shape a course SW. $\frac{1}{2}$ W. (S. $57^{\circ} 30'$ W.)

on the Hen and Chickens Range. Run $\frac{3}{4}$ mile on this course, then change to a

course S. $\frac{1}{4}$ E. (S. $2^{\circ} 49'$ E.)

with the Harwood Range lights astern and the Dark Hole West Range lights ahead. When between the black and red spar buoys just north of Point of Woods, change to a

course S. by E. (S. $11^{\circ} 15'$ E.)

and bring the lights of Dark Hole East Range in line ahead.

A run of $\frac{1}{2}$ mile should bring on the range line of Point of Woods light and Rains Wharf (Canadian) lights, heading a

course, on this range, SE. $\frac{1}{2}$ E. (S. $50^{\circ} 37'$ E.)

until on the Canadian Sailors Encampment Range (Upper and Lower), when head a

course, on the range, S. $\frac{1}{8}$ W. (S. $9^{\circ} 50'$ W.)

until abeam of United States Encampment Crib light. Keeping this light to starboard, thence a

course S. by W. $\frac{1}{2}$ W. (S. $16^{\circ} 52'$ W.)

carries to Mud Lake Can Buoy, 3 ($3\frac{1}{2}$) miles. From here a

course SE. $\frac{3}{8}$ E. (S. $49^{\circ} 13'$ E.),

with Winter Point Range lights in line, astern, until Point aux Frenes bears SW. by W. $\frac{1}{2}$ W. (S. $61^{\circ} 52'$ W.), or at night until the change from the red sector to the white light of Round Island is made, then a

course south

will carry past Round Island. Continue this south course for 2 miles from Round Island abeam, when a

course SE. by E. $\frac{1}{2}$ E. (S. $61^{\circ} 52'$ E.)

must be held until Sweets Point light bears abeam, when keep in mid-channel between Pipe Island light and Gaffney Point on a

course SW. (S. 45° W.)

Keep this (leaving the spar buoy on reef to starboard) until Point Detour light opens east of Frying Pan Island light, when a

course S. $\frac{1}{2}$ W. (S. $5^{\circ} 37'$ W.)

will carry into Lake Huron, to a point $\frac{1}{2}$ mile distant from the black buoy, and with it in range with Point Detour lighthouse, NW. by W. $\frac{1}{8}$ W. (N. $57^{\circ} 39'$ W.) This is taken for the point of departure.

HAY LAKE CHANNEL.

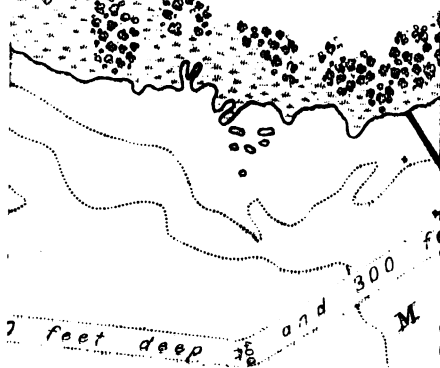
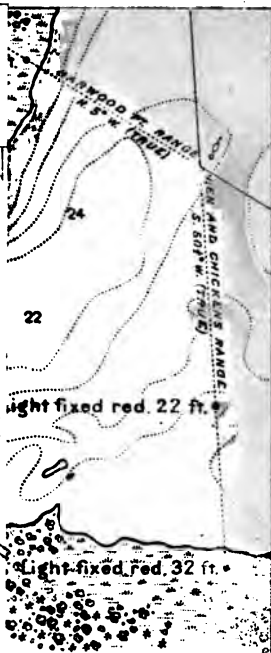
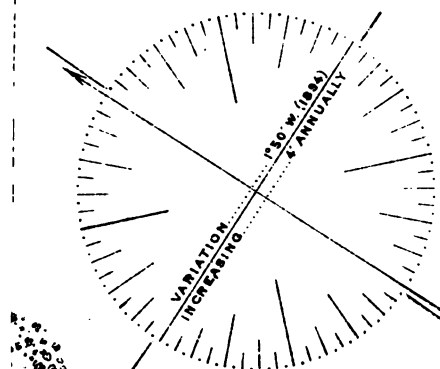
Hay Lake Channel is the channel cut south of Sugar Island through Sugar Island Rapids and Middle Neebish. It was originally intended to have a channel 300 feet wide in the straight portions and 450 feet at the angles, with a 17-foot depth, but the project was subsequently modified to increase the navigable depth to 20 feet, except where bed rock occurred, when a depth of 21 feet was required.

On account of the great increase of traffic it is desirable that the width of the channel be increased to 400 feet with a depth of 21 feet throughout at the lowest water.

It leaves the present channel of St. Marys River at Sugar Island Rapids, about $2\frac{1}{2}$ miles below the canal, cuts through the rapids and islands into Hay Lake, and then, by way of the Middle Neebish, it rejoins the original channel at the foot of Sugar Island.

A

N



I.

VEEBISH



A course of ESE. $\frac{3}{4}$ E. (S. $71^{\circ} 43'$ E.) will carry from the east end of the Sault Sainte Marie Canal to the mouth of the new channel. Thence through the channel a course of SSE. $\frac{1}{2}$ E. (S. $28^{\circ} 07'$ E.) until 2,000 feet beyond Frechette Point and nearly abeam of the NW. side of Ooawsee Bay, when the course should be changed to SE. $\frac{1}{2}$ S. (S. $39^{\circ} 22'$ E.) to the outlet in the head of Hay Lake. From the outlet a course SSE. E'ly (S. 23° E.) can be held until Nine Mile Point bears SE. by E. $\frac{3}{4}$ E. (S. $66^{\circ} 05'$ E.), when the course should be SSE. $\frac{3}{4}$ E. (S. $29^{\circ} 31'$ E.) which will lead into the channel cut through the shoal water in the foot of Hay Lake, until the bend at Middle Neebish is reached, when a course of ESE. $\frac{1}{4}$ E. E'ly (S. 69° E.) can be held until the Harwood Range is made, when head a course of S. $\frac{1}{4}$ E. (S. $2^{\circ} 49'$ E.) with the range lights in line astern. Thence proceed as directed on page 49.

PROPOSED LIGHTING OF HAY LAKE CHANNEL.

The following scheme for lighting this channel is proposed, commencing at the southern entrance of the Middle Neebish section:

No. 1, a crib light (white) on the south side of the entrance to the SE. end of Middle Neebish.

Nos. 2, 4 and 6, three post lights (red) on the dike on the north side of the cut.

Nos. 3, 5 and 7, three lighted floats (white) on the south side of the cut.

No. 8, a lighted float (red) on the north side, opposite the crib light at the NW. entrance.

No. 9, a crib light (white) on the south side of the NW. entrance to Middle Neebish Channel.

No. 10, a light (white) on the head of Neebish Island, (forming, with No. 8, a range).

Nos. 11, 13 and 15, three white lighted floats to mark the south side of Lower Hay Lake Cut.

Nos. 12, 14 and 16, three red lighted floats to mark the north side of Lower Hay Lake Cut.

Nos. 17 and 18, Hay Lake Range (white), near Six Mile Point, being a prolongation of the range formed by Nos. 8 and 10.

Nos. 19 and 20, Six Mile Point Range, (white) a guide through the Little Rapids section.

No. 21, a crib light (white) on the west side of the entrance to the lower cut of the Little Rapids section, with a red sector to cover the shoal off Six Mile Point.

No. 23, a lighted float or post light (white) at the junction of the two Little Rapids sections.

Nos. 22 and 24, (white) Ranges on Frechette Point to guide through lower cut of the Little Rapids.

Nos. 25 and 27, two post lights (white) on the south side of the cut.

Nos. 26 and 28, two post lights (red) on the north side of the cut.

No. 29, a crib light (white) on the south side of the north end of the cut.

No. 30, a crib light (red) on the north side of the north end of the cut.

Upon the completion of these lights, full particulars will be published.

DETOUR PASSAGE.

This passage is between Sweets and Dix Points on the north, and Point Detour and the shoals off Barbed Point on the south. In the middle of the northern entrance is Pipe Island, with shoals extending $\frac{1}{2}$ mile to the northward, and $\frac{1}{2}$ mile in breadth, with islets and rocks at the northern and western extremes. The shoal also extends to the eastward from the island, and curves to the southward and eastward for $\frac{1}{2}$ mile, with $2\frac{1}{2}$ fathoms at its extremity.

WEST SHORE.

Sweets Point, the NW. entrance point, has islets, reefs and shoals extending northward for nearly $\frac{3}{4}$ mile, with a breadth of $\frac{1}{2}$ mile. There are 6 fathoms close to the edge of the shoal, which is marked by a spar buoy. The shoal follows the shore from Sweets Point to and around Gaffney Point.

Sweets Point Buoy marks a shoal spot with 14 feet of water over it, to the northward and westward of Sweets Point light. It is moored in 14 feet of water, and is a 25-foot spar buoy, painted black.

Sweets Point Light.—A fixed white light, visible 6 (7) miles, shown from a white upright rising from a small white house with a red roof, built on a crib.

The crib is in 7 feet of water, off Sweets Point, 2 ($2\frac{1}{4}$) miles NW. $\frac{1}{8}$ W. (N. 54° 50' W.) of Pipe Island light.

It marks the turning point in the channel.

About 2 ($2\frac{1}{4}$) miles from Sweets Point is

Pipe Island Light.—A fixed red light, visible $8\frac{1}{2}$ ($9\frac{1}{2}$) miles, on the SW. side of Pipe Island. It is exhibited from an octagonal white brick tower, surmounted by a black lantern; a detached frame dwelling, one and a half stories high, stands 50 feet from the tower. The tower is $37\frac{1}{2}$ feet above the lake level, and marks the east side of the channel between Pipe Island and the mainland.

On the west side, and nearly opposite Pipe Island, is Gaffney Point; a short distance SE. of which is a rocky shoal marked by a spar buoy.

Five-Foot Shoal Buoy is moored in 14 feet of water on the east side of the 5-foot shoal, SE. of Gaffney Point.

It is an 18-foot spar buoy, painted black. Vessels should pass 100 yards to the eastward of the buoy.

The shore is then steep-to to Detour P. O., where there is a pier called Newells Wood Wharf. SE. of this pier is Frying Pan Island and light.

Frying Pan Island Light.—A fixed red light, visible $7\frac{1}{4}$ ($8\frac{1}{2}$) miles, on Frying Pan Island. It is $18\frac{1}{2}$ feet above the lake level, and is shown from a conical, white iron tower.

It marks the west side of Detour Passage, and is 2 miles from Detour light.

This light, with Pipe Island light, forms a range for entering or leaving Detour Passage.

From this to Point Detour, the shore is bordered by rocks, reefs, and shoals, but it can be approached to $\frac{1}{2}$ mile.

Detour Light.—A fixed white light, visible $14\frac{1}{4}$ ($16\frac{1}{2}$) miles, is shown from a white, skeleton, iron tower with a stair cylinder. The tower is connected with a white frame dwelling by a covered way.

It marks the west side of the entrance to the St. Marys River.

Fog Signal.—There is a fog signal building 50 feet east of the light. A 10-inch steam whistle gives a blast of 8 seconds duration, followed by a silent interval of 52 seconds.

Detour Shoal Buoy marks a shoal NE. by E. of Point Detour, distant $\frac{1}{4}$ mile. It is moored in 16 feet of water, and is a 25-foot spar buoy, painted black. Leave this buoy $\frac{1}{2}$ mile to the westward in passing.

Detour Reef Buoy.—SE. by E. $\frac{1}{2}$ E. (S. $57^{\circ} 39'$ E.), distant $\frac{1}{10}$ mile from Detour Point, is a 3-fathom shoal marked, on its eastern side, by a black second-class can buoy, moored in 18 feet of water, on the easterly side of the reef.

EAST SHORE.

Drummond Island, from Dix Point to Point Lookout and Barbed Point, forms the eastern shore of this passage.

Dix Point is surrounded by reefs extending to the NW. for $\frac{1}{2}$ mile. The whole eastern shore of the passage is bordered by shoal water and off-lying rocks, but can be approached to $\frac{1}{2}$ mile. South of Barbed Point, $\frac{2}{10}$ mile distant, is an offlying reef, with a narrow channel between it and the rocky reef extending from the point.

Port Collier is to the eastward of Barbed Point. There are many off-lying reefs, rocks, and shoals, and several large islands off the entrance, also between Barbed Point and Fair Island.

There are deep, narrow channels amongst these islands and reefs. The water in the harbor is deep, but navigable only for small craft, and by those well acquainted with this coast.

CHAPTER IV.

STRAITS OF MACKINAC.

STRAITS OF MACKINAC.

The Straits of Mackinac on the $45^{\circ} 50'$ parallel, between Point Detour and the NE. point of the Lower Peninsular of Michigan on the east, and Waugoshance light and Point aux Chênes on the west, are $41\frac{1}{2}$ (48) miles long. At the eastern and western entrances between the points mentioned the Straits are respectively $22\frac{1}{2}$ ($26\frac{1}{2}$) and 11 ($12\frac{1}{2}$) miles wide, but contracted in the Straits proper to $4(4\frac{1}{2})$ miles in width between Point St. Ignace on the north, and Mackinac lighthouse on the south. It is here further narrowed by Graham Shoals on the north shore; these shoals are marked by buoys, and are not in the direct route of vessels using the south channel; vessels using the north channel must pass south of the red bell buoy on the south shoal.

The north shore of the Straits is much indented by bays and lined by islands. There are several offlying shoals, but the water is deep close-to, and they offer no serious obstructions to navigation, being out of the direct track.

The south shore of the Straits is comparatively free from indentations. Shoal water extends some $4(4\frac{1}{2})$ miles WNW. from the extremity of Waugoshance Point; the outer extremity of this shoal being marked by Waugoshance lighthouse.

The water in the Straits is generally deep, and the shoals lying near the usually traveled routes are marked by lighthouses, lightvessels or buoys.

ROUTES.

Point Detour to Duck Island Light.—With the buoy on range with Point Detour light, and distant $\frac{1}{2}$ mile, a course SE. by E. $\frac{1}{4}$ E. (S. $59^{\circ} 03'$ E.) for $44(50\frac{1}{2})$ miles, will bring Duck Island light abeam to port, distant $3\frac{1}{2}(4\frac{1}{2})$ miles.

Point Detour to Presqu' Ile Light.—With the buoy on range with Point Detour light, and distant $\frac{1}{2}$ mile, a course SSE. $\frac{1}{4}$ E. (S. $30^{\circ} 56'$ E.) for $39\frac{1}{2}(45\frac{1}{2})$ miles, will bring Presqu' Ile light abeam to starboard, distant $4(4\frac{1}{2})$ miles.

Point Detour to Cheboygan.—With the buoy on range with Point Detour light, and distant $\frac{1}{2}$ mile, a course SW. $\frac{1}{8}$ W. (S. $46^{\circ} 24'$ W.)

for $14\frac{1}{2}$ ($16\frac{3}{4}$) miles, will bring Spectacle Reef light abeam to port, distant $\frac{1}{2}$ mile. Thence SW. by W. $\frac{3}{8}$ W. (S. $63^{\circ} 16'$ W.) $14\frac{1}{2}$ ($16\frac{3}{4}$) miles, passing southward of Poe Reef lightvessel, to a point $\frac{1}{2}$ mile NNE. $\frac{1}{8}$ E. (N. $32^{\circ} 20'$ E.) from the Crib light off Cheboygan, then follow directions for entering that harbor.

Point Detour to Waugoshance Light.—With the buoy on range with Point Detour light, and distant $\frac{1}{2}$ mile, a course WSW. $\frac{1}{2}$ W. (S. $73^{\circ} 07'$ W.) for $23\frac{1}{2}$ (27) miles, will carry a vessel to Bois Blanc light abeam, distant $1\frac{1}{2}$ ($1\frac{3}{4}$) miles. Thence W. $\frac{3}{8}$ N. (N. $85^{\circ} 46'$ W.) $7\frac{1}{2}$ ($8\frac{3}{4}$) miles to the channel between Mackinac and Round islands.

With the red buoy in this channel abeam to starboard a course WSW. $\frac{3}{8}$ W. (S. $71^{\circ} 43'$ W.) for $5\frac{1}{2}$ ($6\frac{1}{2}$) miles, will bring Old Mackinac Point light abeam, distant $1\frac{1}{2}$ ($1\frac{3}{4}$) miles. Thence W. $\frac{1}{4}$ S. (S. $87^{\circ} 11'$ W.) for $14\frac{3}{4}$ (17) miles to abeam of Waugoshance light, distant $\frac{3}{4}$ mile. From this latter position a course can be shaped to any port on Lake Michigan.

NORTH SHORE.

From Point Detour the north shore trends in a westerly direction for nearly $37\frac{3}{4}$ (44) miles, then it abruptly changes its direction to nearly south for $12\frac{1}{4}$ (14) miles to Point St. Ignace. From Point St. Ignace to Point aux Chênes the coast is clear of danger at the distance of a mile excepting the Graham Shoals.

Point Detour is a long, narrow peninsula forming the SW. entrance to Detour passage. There are 18-foot patches at $\frac{3}{4}$ mile SW. and SE. of the point, the latter being marked by a buoy.

Point St. Vital is $3\frac{1}{2}$ (4) miles west of Point Detour, the shore between receding to the northward, forming a large bay open to the southward. In the NE. part of this bay is Carlton Bay, which might afford protection, to small craft, from northerly winds. Seven (8) miles from Point St. Vital is Beaver Tail Point. There are several outlying shoal patches here, and the shore should not be approached within $1\frac{1}{4}$ ($1\frac{1}{2}$) miles. One and one-half ($1\frac{3}{4}$) miles west of Point St. Vital is Saddlebag Island, and $2\frac{3}{4}$ ($3\frac{1}{4}$) miles further westward, Albany Island.

Martin Reef is a rocky shoal having 7 feet least water, with shoals all around; the SE. end of this reef is $3\frac{1}{2}$ (4) miles S. by E. $\frac{3}{4}$ E. (S. $19^{\circ} 41'$ E.) from Beaver Tail Point, and $6\frac{1}{4}$ ($7\frac{1}{4}$) miles WSW. $\frac{1}{4}$ W. (S. $70^{\circ} 18'$ W.) from Point St. Vital. The reef extends one ($1\frac{1}{4}$) miles northwesterly, with deep water between the shoal patches. It is a menace to navigation, as it lies nearly in the track of vessels bound from Detour Passage to the channel between Mackinac and Round islands.

Between Martin Reef and the mainland in a northwesterly direction are Tobin Reef, Surveyors Reef, and other patches with channels between; none of these channels should be attempted by strangers.

Buoy.—A first-class can buoy, painted black, is moored off the SE. end of Martin Reef in 20 feet of water. Vessels should pass south of this buoy.

Coast.—Between Beaver Tail Point and Point Fuyards, $8\frac{1}{2}$ (10) miles to the westward is a large indentation in which are several large and small islands, the principal of which are Strong, Boot, Ile la Salle and Ile Marquette, the latter a large island with Marquette Bay on its NW. side. Amongst these islands are many inlets (Scammon harbor being the largest), but on account of offlying shoals they are practically useless, except for small craft.

Goose Island, $2\frac{1}{2}$ ($2\frac{1}{2}$) miles WSW. of Point Fuyards, is surrounded by shoals; a reef extending for over one mile SSE. from its SE. end. From the eastern side, shoals extend out $\frac{1}{2}$ mile with deep water between them and Marquette Island. From the western side, shoals extend off nearly $\frac{1}{2}$ mile westerly and southwesterly; this side of the island should not be approached within a mile.

Reef.—At $2\frac{1}{2}$ (3) miles SW. by W. $\frac{1}{2}$ W. (S. $61^{\circ} 52'$ W.) from Goose Island is a 6-foot patch with a 9-foot patch a short distance north of it. This reef is $\frac{1}{2}$ mile long north and south, and $\frac{1}{3}$ mile in breadth, being nearly circular in shape. It should be carefully avoided in navigating this part of the Straits.

Point Brulée.—Between the NW. shore of Ile Marquette and Point Brulée is an indentation forming Marquette and other bays; at the head of Marquette Bay is the village of Hessel. There is deep water in these bays, with many shoal spots, and they are only suitable for small craft.

Search Bay.—West of Point Brulée the shore recedes, forming Search Bay, open to the southward, its western boundary being Point St. Martin. The bay has deep water, no offlying dangers, and would serve as a shelter from northerly winds.

Point St. Martin is steep-to, and has a deep water channel between it and a rocky shoal extending east and west one ($1\frac{1}{4}$) miles in a direction parallel to the face of the point.

St. Martin Bay.—Between Point St. Martin and Gross Point is St. Martin Bay, a large bay, free from shoals, and with deep water; it is protected from all winds from east to south by way of north, and from SE. winds partially by Ile St. Martin and Grosse Ile St. Martin; between these islands and the mainland are three channels into the bay, all having deep water. There are several rivers flowing into this bay at its head, the largest being the Pine and Carp rivers.

Ile St. Martin, circular in shape, over a mile in diameter, lies $1\frac{1}{4}$ ($1\frac{1}{2}$) miles to the westward of Point St. Martin, the channel between being perfectly safe if a mid-channel course is kept.

From the south and SW. sides of this island, shoal water extends out

for nearly a mile, and these sides of the island should be given a good berth in rounding it; the rest of the island is steep-to.

Grosse Ile St. Martin is nearly $1\frac{3}{4}$ (2) miles long NNW. and SSE. and $1\frac{1}{4}$ ($1\frac{1}{2}$) miles broad at its widest part. Shoals extend off $\frac{1}{2}$ mile from the several points of the island. The channel between the islands is deep and safe. A course should be kept a little nearer to Ile St. Martin after passing the shoals extending from that island. This course will clear the spit extending $\frac{1}{2}$ mile off the low east point of Grosse Ile St. Martin.

The channel west of Grosse Ile St. Martin is also deep and safe in mid-channel. Shoal water extends to the eastward from Gross Point and to the westward from the NW. point of Grosse Ile St. Martin.

Coast.—Between Gross Point and Rabbits Back Peak, $3\frac{1}{2}$ (4) miles to the southward, the coast recedes forming a bay open to the eastward; south of the peak is a small bight of shoal water, open to the SE., thence the coast trends SSE. for $3\frac{1}{2}$ (4) miles to Point St. Ignace, with East Moran Bay, which is small and open to the eastward, $1\frac{1}{4}$ ($1\frac{1}{2}$) miles NW. of the point.

St. Ignace is on this bay, and projecting into the bay are several railroad docks.

Graham Shoals.—North Graham lies $\frac{3}{4}$ mile SSE. of Point St. Ignace, and has a least depth of 8 feet. South Graham lies $\frac{3}{4}$ mile SSW. of North Graham and $1\frac{1}{4}$ ($1\frac{1}{2}$) miles south of Point St. Ignace, and has a least depth of 6 feet. There is a channel between the shoals and Point St. Ignace, but it should not be attempted.

Currents.—The currents in the vicinity of Graham Shoals and in the Straits of Mackinac are often strong and irregular. After fresh gales, vessels anchored in the Straits often tail to windward.

Buoys.—A second-class can buoy, painted red, is moored in 15 feet of water on the south side of the center of North Graham Shoal.

A first-class automatic bell buoy, painted red, is moored on the southeasterly edge of South Graham Shoal in 24 feet of water. Vessels should pass south of this buoy.

Coast.—From Point St. Ignace the coast trends WSW. for $2\frac{1}{2}$ ($2\frac{3}{4}$) miles to Point la Barbe, thence it changes direction to the NW. for $2\frac{1}{2}$ (3) miles to West Moran Bay. All this coast is bordered with shoals and should not be approached within a mile.

From West Moran Bay the coast is bluff, bending to the northward as far as Gros Cap, and is steep-to; thence it takes a northwesterly direction for $3\frac{1}{2}$ (4) miles to Point aux Chênes, becoming low and broken by inlets, with shoal water extending off some distance. From Point aux Chênes the coast trends northwesterly into Lake Michigan.

St. Helena Island lies $1\frac{1}{2}$ ($1\frac{3}{4}$) miles off the bluff, between West Moran Bay and Gros Cap. It is about a mile long NE. and SW., but shoal

water extends from its SE. side for nearly $\frac{3}{4}$ mile, its outer extreme being marked by a

Buoy.—On the SE. end of a shoal extending southeastward from St. Helena lighthouse, a 25-foot spar buoy, painted black, is moored in 18 feet of water. In entering St. Helena Harbor from the westward, give this buoy a berth of 100 yards.

There is deep water between the mainland and this island.

Light.—On the SE. point of St. Helena Island is a white conical tower, 65 feet high, connected by a covered way with a red brick dwelling, having a red roof. From this tower a fixed red light is shown, visible 14 ($16\frac{1}{2}$) miles.

This light is a guide to vessels making a lee under St. Helena Island, and also a leading mark to vessels bound to the westward through the south channel of the Straits of Mackinac.

Caution.—Do not attempt to round the northwestern end of this island at night, unless its appearance under Gros Cap and the position of St. Helena Shoal are well defined and understood.

St. Helena Shoal, is $1\frac{1}{2}$ ($1\frac{3}{4}$) miles west of the northwestern end of St. Helena Island, with deep water between, and with from 8 to 15 feet of water over it.

The shoal is 750 yards in extent NW. and SE., and 500 yards NE. and SW., with 8 feet on its shoalest (southeastern) edge. The soundings are irregular, bottom rocky, with from 3 to 4 fathoms close-to. On the south side of the shoal is a

Buoy.—A second-class can buoy, painted in red and black horizontal stripes, marks the southern edge of the shoal.

SOUTH SHORE.

From the NE. point of the Lower Peninsula of Michigan to Cheboygan lighthouse the coast takes a general WNW. direction for $8\frac{1}{4}$ (10) miles, and can be approached to $\frac{3}{4}$ mile. West of the lighthouse is McLeod Bay, extending to the SE., but almost filled with shoals having deep water channels amongst them.

In the western part of the bay shoal water extends a mile off shore. There is an 11-foot patch $\frac{1}{2}$ mile NW. by W. (N. $56^{\circ} 15'$ W.) from the Crib light, and a 3-foot rock one ($1\frac{1}{2}$) miles NW. by W. $\frac{3}{4}$ W. (N. $60^{\circ} 28'$ W.) from the same light.

Buoy.—At $\frac{3}{4}$ mile NNE. of Cheboygan lighthouse is Cheboygan Shoal with but $14\frac{1}{2}$ feet of water over it. A second-class nun buoy, painted black, is moored in 16 feet of water on the northern side of the shoal, and should be left to the southward in passing it.

Light.—On the north point of the land to the eastward of McLeod Bay is Cheboygan Light Station, a square tower, 33 feet high, rising from

a dwelling from which is shown a fixed white light, varied by a white flash every minute, and visible $11\frac{1}{2}$ (13) miles.

Fog Signal.—The fog signal at this station is a 10-inch steam whistle, giving a blast of 5 seconds, followed by a silent interval of 25 seconds. The fog signal building is NE. of the lighthouse.

Light.—On an isolated crib off the west side of the dredged channel into Cheboygan River, is an iron octagonal tower $26\frac{3}{4}$ feet high, from which is shown a fixed red light, visible $11\frac{1}{2}$ (13) miles. Vessels bound to Cheboygan should pass the crib close-to and then take the range.

Cheboygan Range Lights are on the west side of the Cheboygan River on the prolongation of the center line of the cut and form a range for passing through the cut.

The front light is 42 feet above the lake level, shown from a square tower rising from a frame dwelling.

The rear light is 68 feet above the lake level, exhibited from an open framework tower. The lights are fixed red, visible $7\frac{1}{2}$ ($8\frac{1}{2}$) miles, and the towers are 1,112 feet apart. The range is SSW. $\frac{1}{8}$ W. (S. $32^{\circ} 20' W.$)

Cheboygan is at the mouth of the Cheboygan River, which drains an area of 850 square miles and empties into McLeod Bay, locally known as Duncan Bay. The locality is a heavy lumber producing district, and its water traffic is important.

Improvements.—A channel 200 feet wide and 15 feet deep has been dredged from the 15-foot curve to the State Road Bridge, marking the upper limit of improvement. This channel has somewhat filled, and it is now contemplated to increase its depth to 18 feet, and extend the outer limit to the 18-foot curve. January, 1894, the available depth was about 13 feet.

A timber crib 40 feet square was built in 1881 on the north side of the entrance in 16 feet of water to mark the exact position of the cut and to serve as a guide for entering it. This crib is used as a foundation for the lighthouse previously described.

Directions.—When a mile off the crib light, make the range on a course SSW. $\frac{1}{8}$ W. (S. $32^{\circ} 20' W.$) and stand in.

Cheboygan to Lake Michigan.—Stand out with range lights or towers astern, in line, SSW. $\frac{1}{8}$ W. (S. $32^{\circ} 20' W.$) until $\frac{1}{2}$ mile outside of the crib light, when change course to NW. by W. (N. $56^{\circ} 15' W.$) and continue this course for $13\frac{1}{2}$ ($15\frac{1}{2}$) miles, when Mackinac light should be abeam, distant $\frac{1}{10}$ mile, then change course to W. $\frac{1}{8}$ N. (N. $88^{\circ} 36' W.$) for $15\frac{1}{2}$ ($17\frac{1}{2}$) miles, which should bring a vessel abeam of Waugoshance light, distant $\frac{3}{4}$ mile; thence to port of destination.

Cheboygan to Presqu' Isle.—Stand out with range lights or towers astern, in line, SSW. $\frac{1}{8}$ W. (S. $32^{\circ} 20' W.$) until $1\frac{1}{2}$ ($1\frac{1}{2}$) miles from the crib light, when change course to east for $6\frac{1}{2}$ ($7\frac{1}{2}$) miles, passing $\frac{1}{2}$ mile to the northward of Cheboygan Shoal buoy, thence change course to SE. by

E. $\frac{3}{4}$ E. (S. $64^{\circ} 41'$ E.) for 45 ($51\frac{1}{2}$) miles, which will take a vessel off Presqu' Isle, thence to port of destination.

Cheboygan to Detour Passage.—Stand out with range lights astern, in line, SSW. $\frac{1}{4}$ W. (S. $32^{\circ} 20'$ W.) until $\frac{1}{2}$ mile from the crib light, when change course to NE. by E. $\frac{3}{4}$ E. (N. $63^{\circ} 16'$ E.) for $14\frac{1}{2}$ ($16\frac{1}{2}$) miles, passing SE. of Poe Reef lightvessel; this should bring a vessel abeam of Spectacle Reef light, thence NE. $\frac{1}{2}$ E. (N. $46^{\circ} 24'$ E.) for $14\frac{1}{2}$ ($16\frac{1}{2}$) miles, will take a vessel off the entrance to Detour Passage, with the buoy on range with Detour Point light and distant $\frac{1}{2}$ mile.

It is not advisable to pass between Poe Reef lightvessel and Bois Blanc Island, except for vessels of light draft.

Coast.—From Cheboygan the coast trends northwesterly for 13 (15) miles to Mackinac City, and it is safe to keep it at a distance of a mile. The 4-fathom curve, excepting off the mouth of the Cheboygan River, in the western part of McLeod Bay, is not more than $\frac{3}{4}$ mile off shore, but it generally follows the shore at about $\frac{1}{2}$ mile.

A little NW. of Point au Sable $4\frac{1}{4}$ ($5\frac{1}{2}$) miles NW. of Cheboygan crib light and at the village of Freedom $3\frac{1}{2}$ (4) miles further on, the edge of the curve is $\frac{3}{4}$ mile off shore.

Mackinac City, on Old Point Mackinac, is an open roadstead, and only protected from NW. winds. The best anchorage for small craft is $\frac{1}{2}$ mile off shore, SE. of the railroad pier.

Light.—On Old Point Mackinac, a light, flashing red every 10 seconds, is shown, and should be visible, in clear weather, $13\frac{1}{2}$ ($15\frac{1}{2}$) miles.

The lighthouse is a cylindrical tower, 50 feet high, and forms the NW. corner of the keeper's dwelling, both built of buff brick; roof of dwelling, red; lantern, black. Fog signal house, 80 feet east of tower, brown.

Fog Signal.—A 10-inch steam whistle gives blasts of 5 seconds duration, with alternate silent intervals of 17 and 33 seconds.

McGulpin Point is $1\frac{1}{4}$ (2) miles to the westward of Old Point Mackinac, the shore between forming a shallow bight with shoal water, open to the northward. The point is bluff, steep-to, and faces the NW. for over a mile. On the north extremity of the point is a

Light.—The light is fixed white, visible 16 ($18\frac{1}{2}$) miles.

The lighthouse, on a bluff 70 feet above the lake level, is an octagonal tower, attached to the NW. corner of the dwelling; both of yellow brick, with red roofs.

The light is a guide through the Straits.

Coast.—From the southwestern extremity of McGulpin Point, the shore recedes to the southeastward for a mile, then trends SW. for 2 ($2\frac{1}{2}$) miles, and then NW. for a mile, forming a bay 2 ($2\frac{1}{2}$) miles wide and a mile deep, with shoal water extending out from the shore for over $\frac{1}{2}$ mile.

This bay affords protection from all winds except those from north to west. From the SW. point of this bay the coast takes a general westerly direction for 8 ($9\frac{1}{4}$) miles to Waugoshance Point, with two shallow bights open to the NW.

This part of the coast should not be approached within a mile, and as the extremity of Waugoshance Point is neared, a still wider berth should be given it.

WAUGOSHANCE POINT, ISLAND, AND SHOALS.

Waugoshance Point, a long, low, and narrow point extends out from the mainland for $1\frac{3}{4}$ (2) miles, and is further continued by several small islets. The point is the top ridge of a long shoal, which extends out from the mainland for $5\frac{1}{2}$ ($6\frac{1}{4}$) miles to Waugoshance lighthouse, the shoal having a mean breadth of $1\frac{3}{4}$ (2) miles. Waugoshance Island, $1\frac{3}{4}$ (2) miles westward of the extremity of the point, is a mile long east and west, and $\frac{1}{2}$ mile broad.

Caution.—In rounding Waugoshance Shoal, do not pass between Waugoshance lighthouse and the island; keep a lookout for Vienna Shoal, and give it a good berth.

Waugoshance Lighthouse, on the northwestern end of Waugoshance Shoal, is 2 miles NW. of Waugoshance Island.

The light is fixed white, varied by a flash every 45 seconds, and is visible $14\frac{1}{2}$ ($16\frac{1}{2}$) miles.

The lighthouse, 65 feet high, is an iron tower, with a dwelling and a fog-signal building, all surrounded by a square crib. The buildings are painted red and white, in alternate horizontal bands. The light marks Waugoshance Shoal and the turning point into Lake Michigan.

Fog Signal.—The fog signal is a 10-inch steam whistle, giving blasts of 5 seconds duration; followed by a silent interval of 25 seconds.

Waugoshance Sixteen-Foot Shoal is $1\frac{1}{2}$ ($1\frac{1}{2}$) miles NW. of Waugoshance light, and on a line between this light and White Shoal lightvessel, and nearly on a line between St. Helena lighthouse and Grays Reef lightvessel.

These ranges will be useful in rounding this shoal at night. The shoal is marked by a

Buoy.—A second-class nun buoy, painted black, moored in 23 feet of water; $\frac{1}{2}$ mile eastward of this buoy is an 18-foot patch. These patches are known as Rose Shoal.

Vienna Shoal is $1\frac{1}{4}$ ($1\frac{1}{2}$) miles WSW. $\frac{1}{2}$ W. of Waugoshance lighthouse; it is 300 yards in length from east to west, and 175 yards from north to south, with a least depth of 13 feet. The NW. point of the shoal is marked by a

Buoy.—A second-class can buoy, painted in red and black horizontal stripes, and moored in 18 feet of water.

Grays Reef Lightvessel.—Between Vienna Shoal and this lightvessel is a channel $2\frac{1}{2}$ (3) miles wide, with deep water.

The lightvessel has two masts, is schooner rigged, showing a black oval cagework day mark at the foremast head, and a red one at the main. Hull red, bulwarks white, with "Grays Reef" in large black letters on each side, and "No. 57" on the stern. The lightvessel is moored in 20 feet of water off the easterly edge of Grays Reef.

A fixed white light is shown at the foremast head, and a fixed red light at the main, each at an elevation of 30 feet above the water, and visible (white) $9\frac{1}{4}$ ($11\frac{1}{4}$) and (red) $7\frac{1}{4}$ ($8\frac{1}{2}$) miles.

Fog Signal.—The fog signal is a 6-inch steam whistle, which sounds as follows: Blast, 3 seconds; silent interval, 10 seconds; blast, one second; silent interval, 10 seconds; blast, one second; silent interval, 35 seconds.

White Shoal Lightvessel, $3\frac{1}{2}$ (4) miles NE. by N. of Grays Reef lightvessel, is moored in 26 feet of water off the eastern edge of White Shoal.

The lightvessel has two masts, is schooner rigged, with a black, oval cagework day mark at each masthead. The hull is white, with "White Shoal" in large black letters on each side, and "No. 56" on the stern.

A fixed white light is shown at each masthead; each being elevated 30 feet, and visible $9\frac{1}{4}$ ($11\frac{1}{4}$) miles.

Fog Signal.—The fog signal is a 6-inch steam whistle, which sounds as follows: Blast, one second; silent interval, 10 seconds; blast, one second; silent interval, 10 seconds; blast, 3 seconds; silent interval, 35 seconds.

Buoy.—A first-class, 35-foot spar buoy, painted in red and black horizontal stripes, is moored at the SW. end of White Shoal in 18 feet of water.

ISLANDS AND SHOALS IN MACKINAC STRAITS.

Under this heading will be considered the islands and shoals in the Straits which lie clear of the coast line, and which can not be considered as forming bounds to bays or harbors. They will be described from the eastward.

Spectacle Reef.—This reef lies 9 ($10\frac{1}{2}$) miles east of the east point of Bois Blanc Island, and is almost in the track of ships bound from Detour Passage to the South Channel of Mackinac Straits. The reef is $\frac{7}{8}$ mile long north and south, and $\frac{1}{2}$ mile broad east and west, with a least depth of 8 feet, on its southern part. On the northwestern edge of the reef from a square crib is shown a

Light.—The light is flashing red and white, alternately, every 30 seconds, and is visible 15 ($17\frac{1}{4}$) miles.

The lighthouse is a conical, gray limestone tower, 97 feet high, with a

dome and railings painted black. A square wooden crib, on which are two white frame fog-signal houses, and a white frame boathouse.

This light serves as a guide to the Straits from the eastward.

Fog Signal.—The fog signal is a 10-inch steam whistle, giving blasts of 3 seconds, with alternate silent intervals of 12 and 42 seconds.

Raynolds Reef, $3\frac{1}{4}$ ($3\frac{3}{4}$) miles to the westward of Spectacle Reef, is a dangerous shoal with from 12 to 13 feet of water over it. It should not be approached nearer than $\frac{1}{4}$ mile. Its northern edge is marked by a

Buoy.—A second-class can buoy, painted in red and black horizontal stripes, is moored in 17 feet of water, and marks this shoal.

Poe Reef is $1\frac{1}{2}$ ($1\frac{7}{8}$) miles from the SE. end of Bois Blanc Island. The reef extends easterly and westerly 2,000 yards, with a least depth of 12 feet of water over it. There is a narrow channel north of it, which should not be attempted by strangers.

On the eastern end of this reef, to mark the north side of the South Channel, in 30 feet of water, is moored a

Lightvessel.—The vessel shows simultaneously from three lens lanterns encircling the foremast head a fixed white light. The light is 40 feet above the lake level, and is visible $11\frac{3}{4}$ ($13\frac{1}{2}$) miles. The vessel has two masts, schooner rigged, without a bowsprit. There is a circular black cagework day mark at the foremast head, with a small black smokestack, and the fog signal between the masts. The hull is red, with "Poe Reef" in large white letters on each side, and "No. 62" on each bow.

Fog Signal.—A 6-inch steam whistle sounds blasts of 5 seconds duration, separated by silent intervals of 10 seconds. If the whistle be disabled, a bell will be rung by hand.

Bois Blanc Island forms the north boundary to the South Channel, Straits of Mackinac. Its greatest length is $9\frac{1}{2}$ (11) miles WNW. and ESE. and its breadth for half this distance is 4 ($4\frac{1}{2}$) miles, narrowing to a mile at its northwestern end.

About $2\frac{1}{4}$ ($2\frac{1}{2}$) miles from its eastern end a narrow peninsula extends out from the northern shore in a northerly direction for $1\frac{1}{2}$ ($1\frac{3}{4}$) miles, tapering at its northern edge to a breadth of but $\frac{1}{4}$ mile. On the NE. point of this peninsula is a

Light.—The light is fixed white, 75 feet above the lake level, and visible $12\frac{3}{4}$ ($14\frac{1}{4}$) miles.

The lighthouse is a square tower, 38 feet high, on a yellow brick dwelling, and serves as a guide into the channel between Round and Mackinac islands.

Shoal.—NW. of the light, distant $\frac{1}{10}$ mile, is a shoal with 17 feet of water over it.

Life Saving Station.—Bois Blanc Station is half way between the east and SE. points of the island.

Coast of the Island.—From the peninsula, the coast of the island trends ESE. for $2\frac{1}{2}$ ($2\frac{1}{2}$) miles and is safe to approach to $\frac{1}{2}$ mile. Shoal water extends off the east point of the island for nearly $\frac{1}{2}$ mile and follows the southeastern side at this distance until off the SE. point, when it extends off in a spit for a mile. From the southern edge shoals extend off for nearly $\frac{3}{4}$ mile, closing in to $\frac{1}{2}$ mile at the point where the southern coast changes its direction to the northwestward. The shoal water follows the trend of the coast to the NW. end of the island except at

Zela Shoal.—At half way between the NW. and SW. ends of Bois Blanc Island a narrow spit extends out northwesterly for $1\frac{3}{4}$ (2) miles from Zela point, and is marked on its extreme NW. end by a

Buoy.—A third-class can buoy, painted red. There is no channel between this buoy and the island.

The northern shore of the island for $3\frac{1}{2}$ ($3\frac{3}{4}$) miles from the north point has shoal water extending out for $\frac{3}{4}$ mile, and Bois Blanc is connected with Round Island by shoals. A rocky shoal of 3 feet lies almost on the edge of the 4-fathom curve one mile NE. of the north point with 76 feet close-to. This is a dangerous spot.

About $3\frac{1}{2}$ ($3\frac{3}{4}$) miles to the eastward from the north point, the shore becomes steep-to and continues so to the end of the peninsula. The bight formed by the peninsula gives good protection from SE. winds.

Round Island is $\frac{1}{2}$ mile from Bois Blanc Island, with which it is connected by shoals. Shoals extend eastwardly $1\frac{3}{4}$ (2) miles from the southeastern side of the island.

The NW. point of the island extends out in a long, narrow point for $\frac{1}{2}$ mile, with shoals on each side.

Shoal.—A 24-foot shoal extends almost to mid-channel between Round and Mackinac islands $1\frac{3}{4}$ (2) miles NE. from the extreme NW. point of Round Island.

Major Shoal lies $2\frac{1}{2}$ ($2\frac{1}{2}$) miles SW. by W. of the NW. point of Round Island.

The general direction of the shoal is NW. and SE., and it is 1,200 feet long. There is a least depth of 14 feet of water 400 feet SE. of the

Buoy.—A second-class can buoy, painted in red and black horizontal stripes, is moored in 19 feet of water on the middle of the shoal.

Mackinac Island, 2 ($2\frac{1}{2}$) miles eastward of Point St. Ignace is $2\frac{1}{2}$ (3) miles long and $1\frac{3}{4}$ (2) miles broad. Its southern part, on which is the town and fort of Mackinac, forms the northern shore of the narrowest part of the Straits of Mackinac. The island is of importance as a military station.

Mackinac.—The town of Mackinac at the SE. end of the island is directly on the north channel of the Straits of Mackinac. Many large

passenger and transient steamers stop here. The town is a coaling station and is a great resort for invalids and tourists.

Harbor.—The harbor is between Biddle and Mission points. It is open to the southward and exposed to the wind from east or west, which often makes such a heavy sea that landing is impossible.

The water front of Fort Mackinac comprises nearly $\frac{1}{3}$ of the water front of the whole harbor.

Buoy.—A third-class can buoy, painted red, is moored in 16 feet of water at the end of a spit extending off from the SW. point of Mackinac Island. Vessels should pass south of it, and avoid the shoal off the NW. point of Round Island.

Directions—From the Eastward.—Steer for the middle of the passage until the docks are ranged, when haul up for them, giving the SE. point of the island a berth of $\frac{1}{4}$ mile.

From the Westward.—Should the buoy off the SW. point of the island not be seen, open up Bois Blanc light a point on the starboard bow until the red light (private light) on the south pier bears north, when haul up for the docks.

For clearing the spit off the SW. point of the island, a good range is the block house on Fort Mackinac on a line with the south pier head.

Current.—During the prevalence of strong easterly or westerly winds a strong current sets through the channel between these islands, sometimes as great as 6 or 8 knots an hour. In the harbor, inside the range of the points, the current is usually contrary to that in the passage and is caused by the eddy.

Anchorage.—Good anchorage is found in the harbor anywhere north of the range of the north pier, in from 3 to 5 fathoms of water. The docks extend out about 500 feet ESE., and have 16 feet of water at their outer ends.

There are no pilots, but tugs are available. Wharfage is charged at the rate of 5 cents per 100 pounds.

CHAPTER V.*

RULES OF THE ROAD.

RULES TO BE OBSERVED BY VESSELS OF THE NAVY AND THE
MERCANTILE MARINE OF THE UNITED STATES, NAVIGATING THE
HARBORS, LAKES, AND INLAND WATERS OF THE UNITED STATES.
(APPROVED BY THE SECRETARY OF THE TREASURY, CIRCULAR NO.
14, OF MARCH 1, 1888.)

PRELIMINARY.

The instructions herein contained will be observed in the navigation of vessels of the mercantile marine of the United States; and by the provisions of the Revised Statutes the following rules, from 1 to 24 inclusive, are made applicable to the navigation of vessels of the Navy. (Collectors will notice the modifications of the circular of February 17, 1877, which is hereby superseded.)

Every sail-vessel of the mercantile marine navigated without complying with the instructions of this circular will be liable to a penalty of two hundred dollars, for which sum the vessel may be seized and proceeded against.

STEAM AND SAIL VESSELS.

RULE 1. Every steam-vessel which is under sail, and not under steam, shall be considered a sail-vessel; and every steam-vessel which is under steam, whether under sail or not, shall be considered a steam-vessel.

LIGHTS.

RULE 2. The lights mentioned in the following rules, and no others, shall be carried in all weathers, between sunset and sunrise.

LIGHTS FOR OCEAN-GOING STEAMERS AND STEAMERS CARRYING SAIL.

RULE 3. All ocean-going steamers, and steamers carrying sail, shall, when under way, carry—

(a) At the foremast head, a bright white light, of such a character as to be visible on a dark night, with a clear atmosphere, at a distance of at least five miles, and so constructed as to show a uniform and unbroken light

* These rules will be changed March 1, 1895.

over an arc of the horizon of twenty points of the compass, and so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side.

(b) On the starboard side, a green light, of such a character as to be visible on a dark night, with a clear atmosphere, at a distance of at least two miles, and so constructed as to show a uniform and unbroken light over an arc of the horizon of ten points of the compass, and so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side.

(c) On the port side, a red light, of such a character as to be visible on a dark night, with a clear atmosphere, at a distance of at least two miles, and so constructed as to show a uniform and unbroken light over an arc of the horizon of ten points of the compass, and so fixed as to throw the light from right ahead to two points abaft the beam on the port side.

The green and red light shall be fitted with inboard screens, projecting at least three feet forward from the lights, so as to prevent them from being seen across the bow.

LIGHTS FOR TOWING-STEAMERS.

RULE 4. Steam-vessels, when towing other vessels, shall carry two bright white mast-head lights vertically, in addition to their side-lights, so as to distinguish them from other steam-vessels. Each of these mast-head lights shall be of the same character and construction as the mast-head lights prescribed by Rule 3.

LIGHTS FOR STEAMERS NOT OCEAN-GOING NOR CARRYING SAIL.

RULE 5. All steam-vessels, other than ocean-going steamers and steamers carrying sail, shall, when under way, carry on the starboard and port sides lights of the same character and construction and in the same position as are prescribed for side-lights by Rule 3, except in the case provided in Rule 6.

LIGHTS FOR STEAMERS ON THE MISSISSIPPI RIVER.

RULE 6. River-steamers navigating waters flowing in the Gulf of Mexico, and their tributaries, shall carry the following lights, namely: One red light on the outboard side of the port smoke-pipe, and one green light on the outboard side of the starboard smoke-pipe. Such lights shall show both forward and abeam on their respective sides.

LIGHTS FOR COASTING STEAM-VESSELS AND STEAM-VESSELS NAVIGATING BAYS, LAKES, AND RIVERS.

RULE 7. All coasting steam-vessels, and steam-vessels other than ferry-boats and vessels otherwise expressly provided for, navigating the bays,

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LIGHTS FOR COAL-BOATS, TRADING-BOATS, RAFTS, AND OTHER
LIKE CRAFT.

RULE 12. Coal-boats, trading-boats, produce-boats, canal-boats, oyster-boats, fishing-boats, rafts, or other water-craft, navigating any bay, harbor, or river, by hand-power, horse-power, sail, or by the current of the river, or which shall be anchored or moored in or near the channel or fair-way of any bay, harbor, or river, shall carry one or more good white lights, which shall be placed in such manner as shall be prescribed by the Board of Supervising Inspectors of Steam-Vessels.*

Rule 12 shall be so construed as not to require row-boats and skiffs upon the River St. Lawrence to carry lights. (Act June 19, 1886.)

LIGHTS FOR OPEN BOATS.

RULE 13. Open boats shall not be required to carry the side-lights required for other vessels, but shall, if they do not carry such lights, carry a lantern having a green slide on one side and a red slide on the other side; and, on the approach of or to other vessels, such lantern shall be exhibited in sufficient time to prevent collision, and in such a manner that the green light shall not be seen on the port side, nor the red light on the starboard side. Open boats, when at anchor or stationary, shall exhibit a bright white light. They shall not, however, be prevented from using a flare-up, in addition, if considered expedient.

LIGHTS ON VESSELS OF THE UNITED STATES NAVY.

RULE 14. The exhibition of any light on board of a vessel of war of the United States may be suspended whenever, in the opinion of the Secretary of the Navy, the commander-in-chief of a squadron, or the commander of a vessel, acting singly, the special character of the service may require it.

FOG-SIGNALS.

RULE 15. Whenever there is a fog, or thick weather, whether by day or night, fog-signals shall be used as follows:

(a) Steam-vessels under way shall sound a steam-whistle placed before the funnel, not less than eight feet from the deck, at intervals of not more than one minute.

(b) Sail-vessels under way shall sound a fog horn at intervals of not more than five minutes.

(c) Steam-vessels and sail-vessels, when not under way, shall sound a bell at intervals of not more than five minutes.

(d) Coal-boats, trading-boats, produce-boats, canal-boats, oyster-boats, fishing-boats, rafts, or other water-craft, navigating any bay, harbor, or

*See additional rules.

river, by hand-power, horse-power, sail, or by the current of the river, or anchored or moored in or near the channel or fair-way of any bay, harbor, or river, and not in any port, shall sound a fog-horn, or equivalent signal, which shall make a sound equal to a steam-whistle, at intervals of not more than two minutes.

STEERING AND SAILING RULES.

SAILING-VESSELS.

RULE 16. If two sail-vessels are meeting end on, or nearly end on, so as to involve risk of collision, the helms of both shall be put to port, so that each may pass on the port side of the other.

RULE 17. When two sail-vessels are crossing so as to involve risk of collision, then, if they have the wind on different sides, the vessel with the wind on the port side shall keep out of the way of the vessel with the wind on the starboard side, except in the case in which the vessel with the wind on the port side is close-hauled, and the other vessel free, in which case the latter vessel shall keep out of the way. But if they have the wind on the same side, or if one of them has the wind aft, the vessel which is to windward shall keep out of the way of the vessel which is to leeward.

STEAM-VESSELS MEETING.

RULE 18. If two vessels under steam are meeting end on, or nearly end on, so as to involve risk of collision, the helms of both shall be put to port, so that each may pass on the port side of the other.

TWO STEAMERS CROSSING.

RULE 19. If two vessels under steam are crossing so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way of the other.

SAIL AND STEAM VESSELS MEETING.

RULE 20. If two vessels, one of which is a sail-vessel and the other a steam-vessel, are proceeding in such directions as to involve risk of collision, the steam-vessel shall keep out of the way of the sail-vessel.

STEAM-VESSEL APPROACHING ANOTHER VESSEL, OR IN A FOG.

RULE 21. Every steam-vessel, when approaching another vessel, so as to involve risk of collision, shall slacken her speed, or, if necessary, stop and reverse; and every steam-vessel shall, when in a fog, go at a moderate speed.

VESSELS OVERTAKING ANOTHER.

RULE 22. Every vessel overtaking any other vessel shall keep out of the way of the last-mentioned vessel.

RIGHT OF WAY.

RULE 23. Where, by Rules 17, 19, 20, and 22, one of two vessels shall keep out of the way, the other shall keep her course, subject to the qualifications of Rule 24.

SPECIAL INSTRUCTIONS.

RULE 24. In construing and obeying these rules, due regard must be had to all dangers of navigation, and to any special circumstances which may exist in any particular case, rendering a departure from them necessary in order to avoid immediate danger.

SAILING-VESSELS TO BE FURNISHED WITH SIGNAL-LIGHTS AND TO SHOW TORCHES.

RULE 25. Collectors, or other chief officers of the customs, shall require all sail-vessels to be furnished with proper signal-lights, and every such vessel shall, on the approach of any steam-vessel during the nighttime, *show a lighted torch* upon that point or quarter to which such steam-vessel shall be approaching.

ADDITIONAL RULES.

These additional rules (found in the proceedings of the Board of Supervising Inspectors of Steam-Vessels and Decisions of Treasury Department) are published for the information of all concerned :

LIGHTS FOR FERRY-BOATS.

RULE 65. All double-ended ferry-boats on lakes and seaboard * shall carry a central range of clear, bright, white lights, showing all around the horizon, placed at equal altitudes forward and aft; also such side-lights as specified in section 4233 of the Revised Statutes, Rule 3, paragraphs *b* and *c*. Local inspectors, in districts having ferry-boats, shall, whenever the safety of navigation may require, designate for each line of such boats a certain light, white or colored, which shall show all around the horizon, to designate and distinguish such lines from each other, which lights shall be carried on a flag-staff amidships, fifteen feet above the white range-lights. * * * The signal-lights on ferry-boats, on waters flowing into the Gulf of Mexico and their tributaries, shall be the same as those on all other steamboats on the same waters, except double-ended ferry-boats, which shall be governed by the rule governing double-ended ferry-boats on lakes and seaboard.

LIGHTS ON SMALL CRAFT.

RULE supplemental to **RULE 12**, and by virtue thereof :

All coal-boats, trading-boats, produce-boats, canal-boats, oyster-boats,

* This rule is intended to apply to all ferry-boats subject to the pilot-rules for seas, gulfs, lakes, bays, sounds, or rivers, except the Red River of the North, or rivers whose waters flow into the Gulf of Mexico.

fishing-boats, and other water-craft, navigating any bay, harbor, or river, propelled by hand-power, horse-power, sail, or by the current of the river, or which shall be moored in or near the channel or fair-way of any bay, harbor, or river, shall carry one bright, white light forward, not less than six feet above the rail or deck.

Rafts of one crib, and not more than two in length, shall carry one bright white light, on a pole not less than six feet high; three or more cribs in length, shall carry one white light at each end of the raft at the same height.

Rafts of more than one crib abreast shall carry one white light on each outside corner of the raft, making four lights in all.

Row-boats shall carry one white light two feet above the stem.

It is *recommended* by the Board of Supervising Inspectors of Steam-Vessels that, whenever there is a fog by day or night, sailing-vessels and every craft propelled by sails upon the ocean, lakes, and rivers, when on the starboard tack, shall sound, with intervals of not more than two minutes, one blast of the fog-horn; when on the port tack, two blasts; when with the wind free or running large, three blasts; and that, when lying-to or at anchor, they shall sound the bell with the same intervals.

FOG-HORNS.

The selection of an instrument to be employed in making the fog-signals required by law must in all cases be left to the master or owner of the vessel, it being only necessary that this Department shall so far regulate such selection that instruments not effective for the purpose shall be excluded.

Any instrument or device for this purpose, which produces a sound equivalent to that of a steam-whistle, will be considered sufficient for the purposes of the law.

CONFLICTING RULES.

Any directions heretofore given by this Department conflicting with the above instructions are hereby revoked.

STEAM-VESSELS TOWING.

"The following rule adopted by the Board of Supervising Inspectors of Steam-Vessels (*see* Circular 29, February 25, 1885) has been approved by the Secretary of the Treasury:

"SECTION 8. All steam-vessels (*except upon the Red River of the North and rivers whose waters flow into the Gulf of Mexico*), when engaged in towing during fog or thick weather, shall sound three distinct blasts of their steam-whistles in quick succession, repeating at intervals not exceeding one minute."

The following section adopted by the Board of Supervising Inspectors (Circular February 11, 1887) has been approved by the Secretary of the Treasury :

“RULE IX.

“SECTION 2. It shall be the duty of the inspectors jointly, before granting a certificate of inspection, to thoroughly test the fire apparatus of steamers, and to examine carefully all pumps, hose, life-boats, and other equipments required by law, *and to see that the [glass globes of] colored signal-lights are in no case less than six inches diameter and six inches high.*”

CIRCULAR.

RESOLUTION RELATING TO, AND AMENDMENTS TO, PILOT RULES.

1894.

DEPARTMENT No. 36.

TREASURY DEPARTMENT,

STEAMBOAT-INSPECTION SERVICE, OFFICE OF THE SUPERVISING INSPECTOR-GENERAL,

THE MALTBY BUILDING, N. J. AVE. AND B ST. NW.,

WASHINGTON, D. C., February 28, 1894.

TO MASTERS AND PILOTS OF STEAM VESSELS :

Your attention is directed to the following resolution of the Board of Supervising Inspectors, approved by the Secretary of the Treasury, regarding the misuse of the whistle signals for steamers passing each other authorized by Pilot Rules, Lakes and Seaboard, also for Western Rivers :

Resolved, That pilots of steam vessels be instructed, through the local inspectors of steam vessels when licenses are being issued to such pilots, either originals or renewals, that the signals provided in Pilot Rules, Lakes and Seaboard, and Western Rivers, for steamers meeting, passing, or overtaking, are never to be used except when steamers are in sight of each other and the course and position of each can be accurately determined, in the daytime, by a sight of the vessel itself; or, at night, by its signal lights.

In fog, mists, or falling snow, when vessels can not see each other, fog signals only may lawfully be given, and pilots should, upon hearing the fog signal of another vessel, ahead, or on either bow, run slow, with frequent stoppages, until the fog signals of the opposing vessel are heard abaft the beam.

And further resolved, That these resolutions be printed in a foot-note on the Pilot Rules, when new editions are printed, and also in circular form, to be presented by the local inspectors to each master and pilot, when issuing to him his license.

AMENDMENTS TO PILOT RULES FOR WESTERN RIVERS.

THE AMENDMENTS TO RULES I, II, AND III ARE INDICATED BY THE WORDS PRINTED IN ITALICS.

*RULE I. When steamers are approaching each other from opposite directions, the signals for passing shall be one blast of the steam whistle to pass to the right, and two blasts of the steam whistle to pass to the left. The pilot on the ascending steamer shall be the first to indicate the side on which he desires to pass; but if the pilot on the descending steamer shall deem it dangerous to take the side indicated by the pilot of the ascending steamer, *he shall at once signify that fact by sounding the alarm or danger signal of three or more short blasts of the steam whistle, and it shall be the duty of the pilot of the ascending steamer to answer by a similar signal of three or more blasts of the whistle, after which the pilot of the descending steamer may indicate by his whistle the side on which he desires to pass, and the pilot of the ascending steamer shall govern himself accordingly, the descending steamer being entitled to the right of way.* But in no case shall pilots on steamers attempt to pass each other until there has been a thorough understanding as to the side each steamer shall take. The signals for passing must be made, answered, and understood before the steamers have arrived at a distance of eight hundred yards of each other.

*RULE II. If from any cause the signals for passing are not made at the proper time, *as provided in Rule I,* or should the signals be given and not promptly understood, from any cause whatever, and either boat become imperiled thereby, the pilot on either steamer may be the first to sound the alarm or danger signal, which shall consist of *three or more* short blasts of the steam-whistle in quick succession. Whenever the danger signal is given, the engines of *both steamers must be stopped* and backed until their headway has been fully checked; nor shall the engines of either steamer be again started ahead until the steamers can safely pass each other.

Vessels approaching each other from opposite directions are forbidden to use what has become technically known among pilots as "cross signals"—that is, answering one whistle with two, and answering two whistles with one. In all cases, and under all circumstances, a pilot receiving either of the whistle signals provided in the rules, which for any reason he deems injudicious to comply with, instead of answering it with a cross signal, must at once observe the provisions of this rule.

*RULE III. When two boats are about to enter a narrow channel at the same time, the ascending boat shall be stopped below such channel until the descending boat shall have passed through it; but should two boats unavoidably meet in such channel, then it shall be the duty of the pilot of the ascending boat to make the proper signal, and when answered, the

ascending boat shall lie as close as possible to the side of the channel the exchange of signals may have determined, as provided by Rule I, and either stop the engines or move them so as only to give the boat steerage way, and the pilot of the descending boat shall cause his boat to be worked slowly until he has passed the ascending boat.

When two steamers are approaching a bridge span or draw from opposite directions, and the passing signals as provided in Rule I have been given and understood, should the pilot of the descending steamer deem it dangerous for the steamers to pass each other between the piers of such span or draw, he shall sound the alarm or danger signal, and it shall then be the duty of the pilot of the ascending steamer to answer with a similar alarm signal, and to slow or stop his engines below such span or draw until the descending steamer shall have passed.

RULE X. The following words, at the end of rule, stricken therefrom :
“ White lights shall also be placed on the extreme side of the tow on either hand, and also on the extreme after-part of the same.”

[*Amendments to Pilot Rules, Western Rivers, take effect May 1, 1894.]

JAS. A. DUMONT,
Supervising Inspector-General.

Approved February 28, 1894 :
W. E. CURTIS,
Acting Secretary.

CHAPTER VI.

SIGNALS.

UNITED STATES AND CANADA.

UNITED STATES STATIONS, LAKE SUPERIOR.

The U. S. Weather Bureau has a Regular Display Station at Duluth, Marquette, and Sault Sainte Marie.

The U. S. Weather Bureau has a Special Display Station at Cheboygan and Detour.

U. S. DEPARTMENT OF AGRICULTURE,

INSTRUCTIONS }
No. 62. }

WEATHER BUREAU,

WASHINGTON, D. C., *August 1, 1894.*

At stations on the Great Lakes the display of the signal known as the "Cautionary Signal" will be discontinued; to take effect September 1, 1894.

Paragraph III of General Instructions No. 8, 1891, is revoked, so far as its provisions apply to stations on the Great Lakes.

The information signal, when displayed at stations on the Great Lakes, will, hereafter, indicate that winds are expected which, in the opinion of the Forecast Official, may prove dangerous to smaller classes of vessels and tows, without reference to any stated velocity.

Nothing in these instructions in any way changes those now in force at the wind signal display stations on the Atlantic, Pacific, and Gulf coasts.

The changes in the wind signal display system on the Great Lakes, enumerated in these instructions, will be given the widest possible publicity through the press at the regular and substations on the Great Lakes. (1806 Mis., 1894.)

H. H. C. DUNWOODY,
Acting Chief of Bureau.

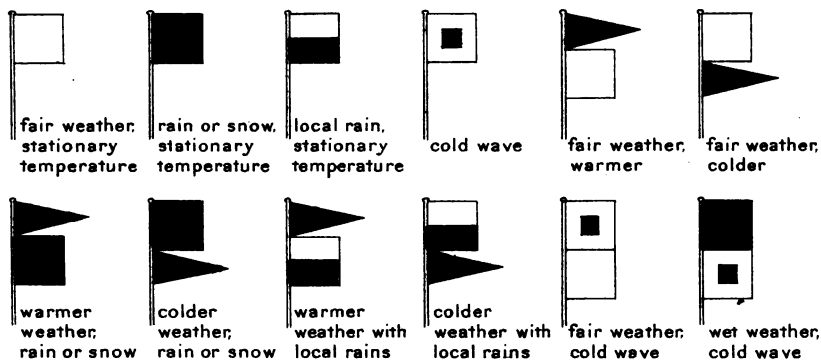
CANADIAN STATIONS, LAKE SUPERIOR.

Fort William and Port Arthur.

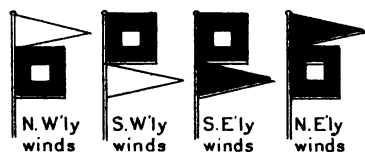
SIGNALS OF DISTRESS.

The Board of Trade gives notice that on and after the first of November, 1873, the following signals shall, in accordance with the 18th section of the Merchant Shipping Act, 1873, be deemed to be signals of distress:

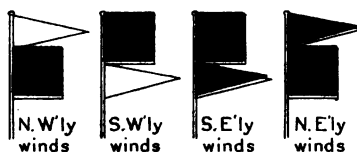
U.S. WEATHER AND TEMPERATURE SIGNALS



U.S. CAUTIONARY SIGNALS



U.S. STORM SIGNALS



Flags 8 feet square. Pennants 5 feet hoist and 12 feet fly.
White centers 4 feet square, black centers 3 feet square.

The Cautionary Signal indicates that the winds expected will not be so severe, but wellfound, seaworthy vessels can meet them without danger.

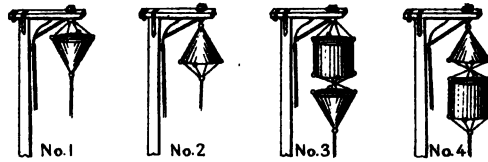
The Storm Signal indicates that the storm is expected to be of marked violence and dangerous to all classes of vessels.

The red pennant when displayed alone is the Information Signal and indicates that the local observer has received information of a storm covering a limited area dangerous only for vessels about to sail for certain points. This signal is intended to be a notification to shipmasters that valuable information will be given them upon application to the local observer.

NIGHT SIGNALS — *By night a red light will indicate easterly winds and a white light above a red light westerly winds.*

CANADIAN STORM SIGNALS

DAY SIGNALS



Day Signal	If displayed on Lakes Superior Erie or Ontario indicates :	If displayed on Lake Huron or in Georgian Bay indicates :
No. 1	a moderate gale is expected at first from an Easterly direction.	a moderate gale is expected at first from a Southerly direction.
No. 2	a heavy gale is expected at first from a Westerly direction.	a heavy gale is expected at first from a Northerly direction.
No. 3	a heavy gale is expected at first from an Easterly direction.	a heavy gale is expected at first from a Southerly direction.
No. 4	a heavy gale is expected at first from a Westerly direction.	a heavy gale is expected at first from a Northerly direction.

The Cone when displayed alone indicates that it is expected that the wind will attain a velocity of 25 miles an hour, but will not exceed 35 miles, and it is not intended to indicate that an ordinary, wellfound vessel should stay in port but is simply a warning that strong winds are expected from the quarter indicated.

The Drum will always be hoisted when the velocity of the wind is expected to exceed 35 miles an hour.

NIGHT SIGNALS

The Night Signal corresponding to Day Signals Nos. 1 and 3 is two lanterns hanging one above the other.

The Night Signal corresponding to Day Signals Nos. 2 and 4 is two lanterns hanging side by side.

October and November are the months in which severe storms most frequently occur on the Lakes. In these fall storms on lakes Erie and Ontario, the wind almost invariably commences at the southeast and works round through south to west and northwest, and the time of the hardest blow is usually when the barometer begins to rise as the wind gets around to the west. On Lake Huron and in Georgian Bay, the wind, though for the most part changing as on the Lower Lakes, not unfrequently changes with great suddenness, chopping after a bill from south-southeast to northwest, and blowing hardest, as a rule, from the northwest.

"In the Daytime.—The following signals, numbered 1, 2, and 3, when used or displayed together or separately, shall be deemed to be signals of distress in the daytime:

- "1. A gun fired at intervals of about a minute.
- "2. The International Code Signal of Distress, indicated N. C.
- "3. The Distant Signal, consisting of a square flag, having either above or below it a ball, or anything resembling a ball.

"At Night.—The following signals, numbered 1, 2, and 3, when used or displayed together or separately, shall be deemed to be signals of distress at night:

- "1. A gun fired at intervals of about a minute.
- "2. Flames on the ship (as from a burning tar barrel, oil barrel, etc.)
- "3. Rockets or shells of any color or description, fired one at a time, at short intervals."

And "any master of a vessel who uses or displays, or causes or permits any person under his authority to use or display any of the said signals, except in the case of a vessel being in distress, shall be liable to pay compensation for any labor undertaken, risk incurred, or loss sustained in consequence of such signal having been supposed to be a signal of distress, and such compensation may, without prejudice to any other remedy, be recovered in the same manner in which salvage is recoverable."

CHAPTER VII.
BRIEF RULES FOR THE USE OF OIL.

BRIEF RULES FOR THE USE OF OIL TO PROTECT VESSELS IN STORMY WATERS.

From the prize essay submitted to the Hamburg Nautical School by Captain R. Karlowa of the Hamburg American Steamship Company.

In the illustrative figures, the flowing lines represent the spreading oil and the arrows denote the direction of the wind and sea.

Fig. 1

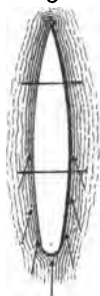


Fig. 2



Scudding before a gale, figure 1, distribute oil from the bow by means of oil-bags or through waste-pipes, it will thus spread aft and give protection both from quartering and following seas.

If only distributed astern, figure 2, there will be no protection from the quartering sea.

Fig. 3

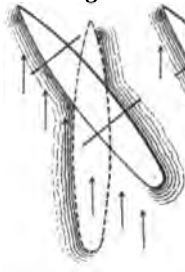
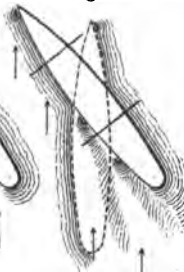


Fig. 4



Running before a gale, yawing badly and threatening to broach-to, figures 3 and 4, oil should be distributed from the bow and from both sides, abaft the beam.

In, figure 3, for instance where it is only distributed at the bow, the weather quarter is left unprotected when the ship yaws.

In, figure 4, however, with oil-bags abaft the beam as well as forward, the quarter is protected.

Fig. 5

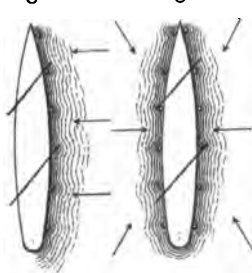


Fig. 6

Lying-to, figure 5, a vessel can be brought closer to the wind by using one or two oil-bags forward, to windward. With a high beam sea, use oil-bags along the weather side at intervals of 40 or 50 feet.

In a heavy cross-sea, figure 6, as in the center of a hurricane, or after the center has passed, oil-bags should be hung out at regular intervals along both sides.

Fig. 7

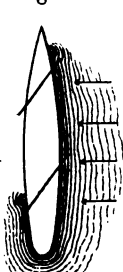
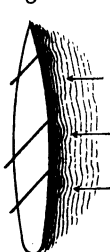


Fig. 8



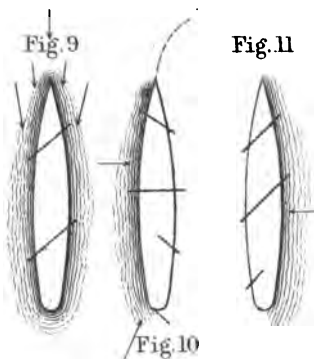
Drifting in the trough of a heavy sea, figures 7, and 8, use oil from waste-pipes forward and bags on weather side, as in figure 8.

These answer the purpose very much better than one bag at weather bow and one at lee quarter, although this has been tried with some success, see figure 7.

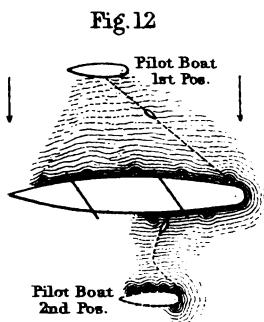
Steaming into a heavy head-sea, figure 9, use oil through forward closet-pipes. Oil-bags would be tossed back on deck.

Lying-to, to tack or wear, figure 10, use oil from weather bow.

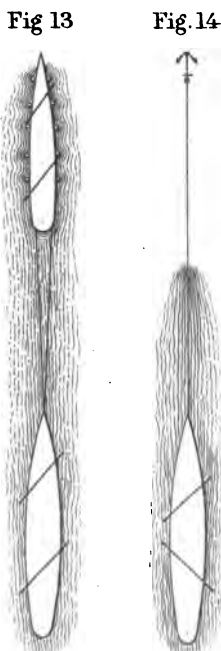
Cracking on, with high wind abeam and heavy sea, figure 11, use oil from waste-pipes, weather bow.



A vessel hove-to for a pilot, figure 12, should distribute oil from the weather side and lee quarter. The pilot-boat runs up to windward and lowers a boat, which pulls down to leeward and around the vessel's stern. The pilot-boat runs down to leeward, gets out oil-bags to windward and on her lee quarter, and the boat, pulls back around her stern, protected by the oil. The vessels drift to leeward and leave an oil-slick to windward, between the two.



Towing another vessel in a heavy sea, oil is of the greatest service, and may prevent the hawser from breaking. Distribute oil from the towing vessel, forward and on both sides, figure 13. If only used aft, the tow alone gets the benefit.



At anchor in an open roadstead, use oil in bags from jib-boom, or haul them out ahead of the vessel by means of an endless rope rove through a tail-block secured to the anchor-chain, figure 14.

CHAPTER VIII.

ANCHORING AND RIDING OUT GALES IN DEEP WATER.

A general rule for anchoring is to give a scope of chain three times the depth of the water, but a safer rule is to give five or even six times the depth.

In anchoring, it is desirable to lay the chain out straight, clear of the anchor. This can be accomplished by keeping headway, or by giving the vessel sternboard before letting go.

If anchoring in deep water it is best to lower the anchor into the water until its weight is taken by the chain, and then let go from the stopper inboard. In cases of anchoring in very deep water it is well to ease the anchor down to within ten or twenty fathoms of the bottom before letting go; by doing this, command can be retained over the chain, and there is less danger of losing it.

A long scope of chain acts as a buffer against the strain of sudden jerks on the anchor and chain, caused by the ship veering about, and rising or falling to the waves. The longer the scope the greater the resistance to this disturbing power.

To increase the value of the long scope a heavy kedge, or other weight, may be secured to the bight of the cable; then veer out more chain; this will bring the strain more in a horizontal direction at the anchor and prevent the latter from tripping.

North Sea fishermen, in their small vessels, use a large cask on their cables during gales of wind, secured between the vessel and the anchor, in order to reduce the direct strain on the ground tackle.

It is recommended to use an empty cask for this purpose, in case of need, and if arrangements are made for running out oil bags to the same before it is launched, the force of the sea will be much reduced, as shown in the article on the subject of oil.

This barrel buoy serves two purposes; the vessel in veering about rides more directly from the barrel buoy than from the anchor itself; hence there is less disturbing force brought upon the anchor, and less probability of fouling it.

By taking up the strain of the chain as the vessel rides up, it guards against the quick-snapping action on the chain when the vessel tautens it

out again, the buoy being dragged through the water counteracting in part this strain.

During the war of the rebellion it was a common practice for vessels on blockading duty to ride out heavy gales of wind at sea, and on a lee shore, while at anchor, with a long scope of chain, and without using oil. Admiral Porter's reports of the operations against Fort Fisher, on the coast of North Carolina, mention numerous instances of severe gales being encountered while at anchor at that point without any accident.

EXTRACTS

from the log books of several vessels during the gale of December 20 and 21, 1864, off Beaufort, North Carolina.

U. S. S. *Brooklyn*: On December 15, anchored with starboard anchor in 15 fathoms of water, veered to 45 fathoms of chain. On December 20 and 21 the wind freshened gradually to a fresh gale from the SW. and a heavy sea made. Early on the morning of the 21st, veered to 75 fathoms and at noon to 100 fathoms. Started engines ahead slow to ease chain. Heavy sea. Ship rolling heavily. Force of wind 7-9. On the 23d, the gale abating, hove in to 50 fathoms.

U. S. S. *Colorado*: Anchored on December 15, in 16 fathoms of water, veered to 60 fathoms of chain on starboard anchor. December 21, fresh gale, veered to 135 fathoms and started engines ahead slow. December 23, hove up starboard anchor and found the arms broken; let go port anchor.

U. S. S. *Tuscarora*: Anchored December 19, in 10 fathoms, veered to 55 fathoms on starboard chain. December 21, ship dragging, veered to 90 fathoms and steamed ahead slow. December 22, got underway, anchoring later in 11 fathoms with 90 fathoms of chain.

U. S. S. *Juniata*: Anchored in 13 fathoms of water with 45 fathoms of chain on starboard anchor, on December 19. On the 20th, a fresh gale blowing, with heavy sea running, veered to 60 fathoms. On the 21st, started to veer more chain. In veering parted stoppers, compressor bolt broke, and not being able to stop the chain, it tore the bolt out of the keelson and parted the end lashing, thereby losing 150 fathoms of chain and an anchor weighing 2,450 pounds. Got under way and stood out. Saw that nearly all the vessels in the fleet had dragged or were dragging their anchors. Twenty second, anchored at 10 A. M. in 14 fathoms of water with 75 fathoms of chain on port anchor.

These vessels were out of sight of land and on a lee shore.

CHAPTER IX.

CURRENTS.

Extract from the "Currents of the Great Lakes, as deduced from the movements of Bottle Papers during the seasons of 1892 and 1893," by Mark W. Harrington, Chief of the Weather Bureau.

The currents in the Great Lakes are grouped under three heads:

1. The main currents:

A general set of the water toward the outlet exists in each of the Great Lakes, forming a continuous current in that direction.

The outlet of Lake Superior being on the southern side, this current hugs the southern shore. In Lake Michigan it hugs the eastern shore, the readiest access to the outlet being on that side, owing to the position of the islands at its northern end. The same rule holds good in Lake Huron as regards the western shore. In lakes Erie and Ontario this phenomenon is not so plainly marked.

2. Surface currents:

These are due to the prevailing winds which have always been recognized as influencing the motion of currents in large bodies of water.

3. Return currents:

The outlets of the lakes being small and insufficient for the escape of all the water banked up by the wind, return currents are inevitable.

The theory has often been propounded that many ocean currents arise from the above cause; the water driven before the wind making the current, and the piled-up water seeking an escape, forming the return current.

OTHER FEATURES.

Barometric changes, as well as other meteorological phenomena, may have an influence on the currents of the Great Lakes. A high pressure of the barometer lying over the southern end of Lake Michigan, for instance, will lower the water at that point, causing a difference of surface level between the two ends of the lake and a resulting flow of water to the southward. Such conditions, however, could hardly endure for any great length of time.

There also occurs occasionally on the Great Lakes a phenomenon which

is called a "Seiche." It is a wave of considerable height, unaccompanied by other waves, appearing as a wall and moving rapidly.

From the above remarks it will be seen that the steadiness and persistence of the lake currents have not yet been determined accurately. Their velocities have been found to vary in speed from 4 to 12 miles a day.

The prevalence of westerly and southwesterly winds favor the strength and persistence of these currents, and it must be remembered that when the motion of the surface water has been communicated to the strata below, a brief change of wind, while affecting the surface, is not so soon communicated to the underlying water.

CURRENTS IN LAKE SUPERIOR.

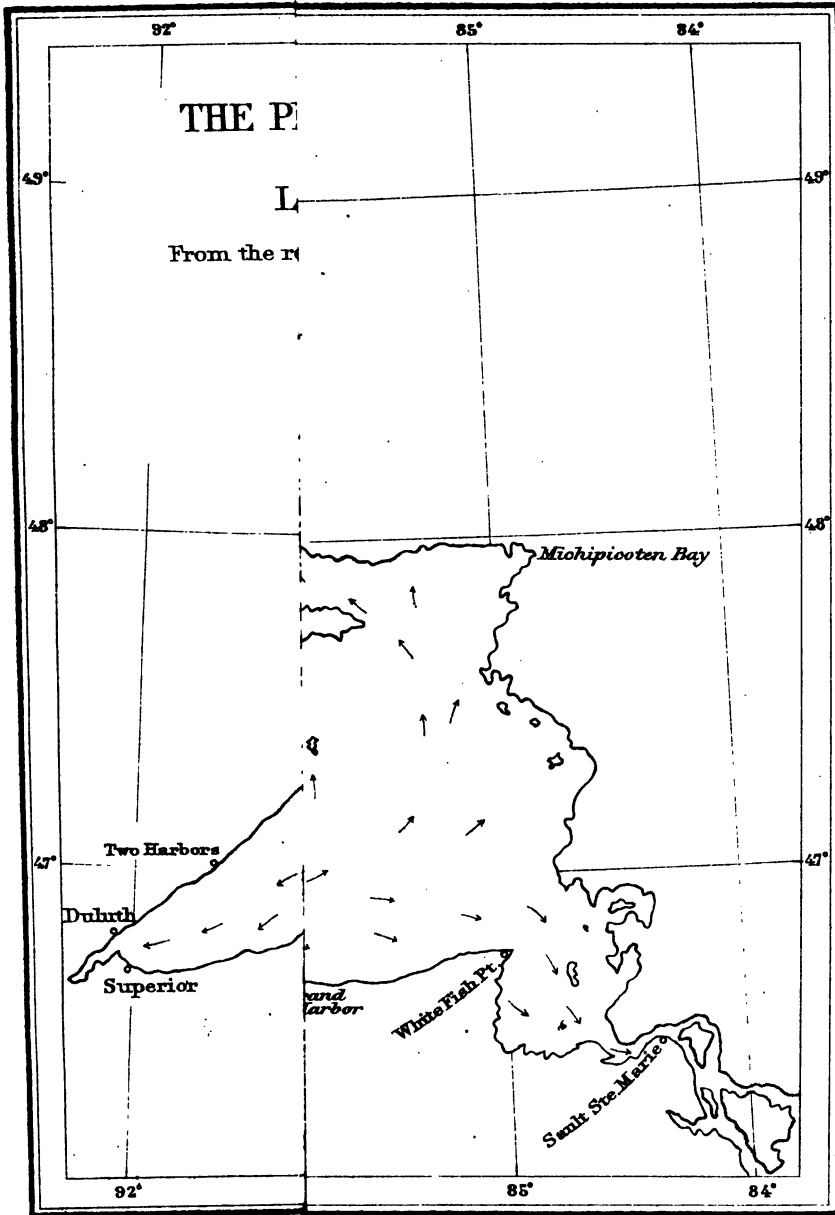
As has been stated, the main current of Lake Superior is to the eastward along the south shore. From the Apostle Islands to the eastward of Keweenaw Point this current has great width, and toward the eastern end of the lake spreads out in the shape of a fan, while a branch passing to the northward and westward reaches the extreme northern coast of the lake.

Another branch turns to the southward around Keweenaw Point, reaches the south coast, moves to the eastward, and again joins the main current east of Marquette, Michigan. In Whitefish Bay there are evidences of a whirl, and to the westward of the Apostle Islands a distinct westerly set exists.

Along the NW. coast the current moves to the westward, turning, apparently, to the eastward near Two Harbors, Minnesota.

An interesting confirmation of the main current is found in the drift from wrecks. From the "Currents of the Great Lakes, as deduced from the movements of Bottle Papers during the seasons of 1892 and 1893," published by the Weather Bureau, it is learned that a considerable portion of the oil jettisoned from the steamer *Northerner* stranded on Keweenaw Point in November, 1892, was recovered at Deer Park, between Grand Marais, Michigan, and Whitefish Point, on the south shore of the lake distant over 200 miles. Many barrels of oil were chopped out of the ice by the Life Saving crew and fishermen at Deer Park.

Isle Royale furnishes indications of a current from the NE. in the sand spits extending to the SW. This is very distinctly shown along several small islands on the south shore.





CHAPTER X.

GENERAL INFORMATION.

The publications of the United States Hydrographic Office for the use of mariners, comprise charts, sailing directions, and light lists, also special books and pamphlets, issued from time to time. They are subject to frequent correction, for information relative to changes in natural and artificial features received subsequent to the date of publication.

The scheme of chart publication embraces three general classes of charts:

1. **General or Sailing Charts**, which cover a large area, and are, therefore, on a comparatively small scale. These are used for laying down routes and proceeding along them. They are for general cruising purposes.

2. **Coast Charts**, which cover less area than the general or sailing charts, and are commonly on a larger scale. They are used for coasting, and for making and leaving the land.

3. **Harbor Charts** are special charts of localities, and are intended for piloting, and for various other local purposes.

For example: A vessel at sea and out of sight of land would use a general or sailing chart. On sighting land, the coast chart would be resorted to, and for entering harbor, the harbor chart would be used.

Sailing directions give additional information, to supplement that contained on the charts, and in greater detail. Light lists also supplement the charts by giving fuller information relative to lights and fog signals. There are also buoy lists published, which give, according to the latest information, the position and character of buoys, beacons, and day marks. These lists serve as checks upon the correctness of the charts.

The effort of the Hydrographic Office is to issue charts which shall be correct up to the date of issue, so far as information at hand permits. In the use of all Hydrographic Office publications, the date of issue should be considered.

Light Lists, published by the Hydrographic Office, which have been corrected for the latest information, are also issued. In cases where light lists published by other departments or nations are issued, the Hydrographic Office is not responsible for their correctness.

Sailing Directions can not, from their nature, be kept fully corrected by the Hydrographic Office by the insertion of slips, etc. Their date

issue should always be carefully considered, and where they differ from charts of later issue, the chart should be taken as the guide.

Notice to Mariners.—In order that charts, sailing directions, etc., may be corrected for information received at the Hydrographic Office subsequent to the date of issue, weekly publications, styled "Notices to Mariners," are issued by the Hydrographic Office to the public free of charge. The Notices to Mariners contain brief itemized statements of special information received. The items are in such shape that they may be cut from the Notices to Mariners and pasted in books, on charts, and in the light lists. The Notices to Mariners also mention the publications that are affected by the several items of information. A list of charts issued and cancelled by the Hydrographic Office, and of the books published, is given in the first notice of each month.

It is seen that this scheme of supply and information assumes that navigators will keep themselves supplied with Notices to Mariners, Supplements, Light Lists, etc., in order that they may keep publications already in their possession corrected for the latest information. Notices to Mariners are supplied from the main Hydrographic Office, in the Navy Department, at Washington, D. C., or from any of the Branch Hydrographic offices, of which there are twelve. The Branch Hydrographic Offices upon the Great Lakes are in the Masonic Temple at Chicago, and in the Arcade Building at Cleveland.

For the correction of Sailing Directions, supplements to the several volumes are published from time to time.

THE USE OF CHARTS.

It is obvious that the value of a chart can never be greater than the value of the survey from which it is made. A correct chart can not be made from an incorrect survey. Given an accurate survey, the appearance or character of a chart may be varied to suit the taste or need of those interested in its use. For mariners, all needless detail is commonly discarded in order that the information contained upon the chart may be impressed quickly upon the mind. Although the charts of the Great Lakes, as a rule, proceed from painstaking surveys, this is not true of all charts, especially certain charts of foreign coasts. To the experienced eye, the appearance of a chart affords a good basis of judgment as to its trustworthiness. In scanning a chart to judge of its value, certain points should be noticed, viz: the date of the survey and by whom the survey was made; the date of issue of the chart; the date at which it has received general correction, and the date at which it has received special corrections. As a rule it may be said that recent surveys are more accurate than those made many years ago. In many places the character of the bottom undergoes change, making resurveys necessary. For such places an old chart

should be accepted with caution. Where charted soundings are distributed evenly over a certain area, but are well opened out one from another, it does not mean necessarily that the soundings shown are all that were taken during the survey. The Hydrographic Office engraves upon its charts only characteristic soundings, and discards for the purpose of chart making soundings which are superfluous. If, on a chart intended to show details, there are no soundings placed over certain areas where they would ordinarily be expected to appear, it may mean that no survey has been made of the vacant areas. It is often the case, however, that soundings are not shown beyond a certain depth of water.

Even in the best surveys a detached pinnacle of rock or other submerged danger may not be discovered. This applies especially to rocky coasts and to the vicinity of outlying rocks. As a rule, therefore, rocky shores and patches should be given a reasonable berth. In using a chart, the notes printed upon it should be carefully read. It may be that charts published by different offices are based upon different plans. For example, one may refer to magnetic courses, and the other to true courses; one may give the bearings of an object on shore as taken from the vessel, and the other the bearing of the vessel from the object on shore. In respect to seaboard charts, one may give depths for mean low water, while the soundings on the other may refer to low water of spring tides, etc. It should also be noted whether the soundings indicate fathoms or feet. In some cases fathoms only are used; in others, only feet; while in other cases feet are designated to depths of three (3) fathoms, beyond which fathoms are shown. In the last case the water areas in depths less than three (3) fathoms or eighteen (18) feet, are dotted or "sanded."

DISTORTION OF CHARTS.

Charts printed from copperplates are subject to distortion. They are printed necessarily on dampened paper. By reason of the dampness the paper has expanded, especially in one direction; that is to say, in the direction in which the fiber of the paper runs. The dimensions of the printed chart coincide with those of the plate immediately after leaving the press, but, in drying, the paper contracts to its original dimensions, thus distorting the printed matter. Different degrees of dampness produce different degrees of distortion. It may be, therefore, that charts printed from the same chart plate at different times and under different conditions of dampness, will not coincide in all their parts if one is superimposed on the other. When this distortion takes place the compass and graduated scales on the chart are distorted in the same ratio as other matter, hence, for the purposes of navigation, no harm is likely to result from the use of plate-printed charts.

As a rule, a chart of the largest scale available should be used for coasting and piloting. For pursuing an extended route with plenty of sea room, there is an advantage in using a chart covering greater area on which both the port of destination and of departure are shown. It should be remembered, however, that in laying down a position from compass bearings, a small error of observation, when plotted, is likely to result in less displacement of position on a chart of a large scale than on one of a small scale. In one case it may reach only yards, and in the other a considerable fraction of a mile. In laying off compass bearings on the chart for fixing a position, bearings on near objects should be used in preference to those on remote objects, because an error in observing the bearing of an object by compass, would have greater effect if continued on the chart through a long distance than through a short distance. Light Lists should always be referred to, as well as the chart, in order to obtain full details of lights. Buoy Lists of the latest issue should also be used to note, when visiting a strange port, if the buoys have been plotted upon the chart according to the latest position assigned to them. In using a Light List it should be remembered, in respect to the range of visibility of a light, as given therein, that it is true only for a certain height of the eye above the water. This is commonly about fifteen (15) feet. If the eye is higher, the light should be seen farther in clear weather, and if the eye is lower, the reverse should be the case. Commonly, the meaning is, that with the eye fifteen (15) feet above water, the light will dip below the horizon when the observer is a greater distance from the light than that of the tabulated range of visibility. Sometimes, however, a light may be so high above the water that the rule as to the range of visibility would give a range beyond the carrying power of the light itself. In such cases the range of visibility is oftentimes assigned on the basis of the power of the light. A good idea of the power of the light may be formed from noting its *order* as given in the Light List.

FOG SIGNALS.

In respect to fog signals, it is almost impossible to lay down any rule as to the range of audibility. The intensity of the sound and its apparent direction are very much influenced by the wind; and to such an extent that the signal may be heard from a remote distance and yet be inaudible or very faint when nearer. Mariners should beware of placing implicit confidence in fog signals.

Good nautical practice requires that the master of a vessel shall know continuously the position of his vessel. In well-known channels or lanes of travel, simple visual observation may give him this information close enough for practical purposes; otherwise, he must resort to the use of his nautical charts and instruments. It is especially important that a

vessel's position should be accurately plotted upon a chart when thick weather shuts out the landmarks. On extended cruises at sea astronomical observations are the main resort of navigators for finding position, but when land is in sight closer results are obtained from compass bearings of landmarks or angular intervals between them, as ascertained by observations on board the vessel. This latter practice embraces two distinct operations. First, taking the observation with the proper instruments of navigation. Second, plotting the results of the observation upon the chart to ascertain the position. The Hydrographic Office charts are plentifully supplied with compass "roses," which give both true and magnetic bearings, marked both for degrees and for compass points.

In using a chart, the theory is that the chart represents with sufficient accuracy a certain area of the surface of the globe over which the vessel is to pursue her way, and that by geometrical processes, very simple in principle, the mariner reproduces upon the chart the actual progress of his vessel along the surface of the globe. Upon the chart various landmarks are printed, all being correctly placed in their mutual relation. If at any time the master of a vessel takes a compass bearing of each of two charted landmarks, and then by means of the compass rose, plots or draws the bearings upon the chart, the intersection of the two plotted lines of bearing, if the objects have been suitably chosen, will intersect upon the chart in the position which corresponds to the actual position of the vessel in the water or upon the globe.

In taking compass bearings it should be borne in mind that certain disturbing influences enter: First, bearings taken with any compass whatever, give only what is called the magnetic bearing of the object, and not the true bearing. This disturbance is caused by the magnetism of the earth, which varies with the locality. To correct any bad results that might proceed from this cause, some charts are provided with lines or figures showing the amount of the magnetic variation in certain localities, and also with compass roses, in different portions of the chart, arranged to correspond with the actual compass in each place, if the compass were not otherwise influenced than by the magnetism of the earth. When the compass is not otherwise influenced, magnetic observations taken by means of the ship's compass, may be laid off on the chart by using the *magnetic* compass roses. Second, in using compass bearings to obtain the ship's position, note must be taken of the error which arises from the effect upon her compass of the iron on board at the time of taking the bearings. This is serious because it differs for different ships, and even for the same ship with a different cargo, or a different arrangement of cargo, when iron enters into the question. It is oftentimes very great in amount, but may be corrected by mechanical means so as to be confined within reasonable limits, so long as the amount and disposition of the iron on

board remains unchanged. If the iron, however, is changed, the local deviation, that is to say, the deviation due to the iron on board the ship, may also change, and very greatly. In order to use compass bearings effectively, for ascertaining the position of a ship, her local deviation on each course, or on each heading of the ship, should be known and applied, since it varies with the course of the ship.

Several methods of obtaining position by means of compass bearings will be given, also the method by means of "horizontal angles." The latter, although not widely practiced by mariners, is incomparably the safer method, especially in order to get a very accurate position of the vessel when the probability of thick weather warns the navigator that he may be obliged to continue his way upon the chart without landmarks in sight, and that he should have a well defined position from which to take a departure. This method eliminates the question of compass error.

Frequently landmarks which are in range, if accurately charted, afford a certain and handy means for obtaining a position. For example, a ship may proceed upon one range which leads over a route or through a channel until she arrives upon another range, when she may perhaps change her course. A chart upon which these ranges are laid down gives at a glance the intersection of the ranges, and therefore, the position of the vessel at the time when both ranges were on.

When the chart is accurate, one compass bearing, or a range, taken in connection with a sounding, may at times give a very trustworthy position, the place of the vessel being pricked off upon the chart where the lines of bearing, or the range line, cuts the depth of water found by getting casts of the lead aboard the vessel.

Another method is by noting when two objects are in range, and then taking with a sextant or alidade, marked to degrees, at least, the horizontal angle at the vessel between the objects in range and a third object conveniently situated. The range is then penciled upon the chart and the angle laid off by means of a metal protractor, or a protractor printed upon tracing paper.

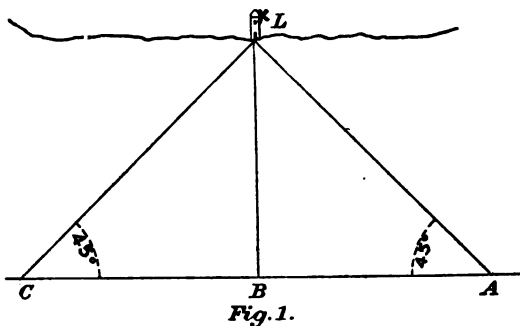
Cross-compass bearings on two landmarks have already been mentioned. When the local deviation of the compass is known, this method, it must be admitted, is more frequently used than any other; but when the vessel has much rolling or pitching motion, compass bearings are difficult to take, entirely aside from the question of local deviation. In plotting lines of bearings, the mutual relations of the lines representing angles or intersections must be considered. If the lines converge sharply upon the chart; that is to say, if the angle between the lines is small, the lines will run along each other so as to make the actual point of intersection difficult to ascertain. It is necessary, therefore, to choose such objects on shore as will give a good intersection of lines upon the chart. The

perfect intersection is when the lines cross at an angle of 8 compass points or 90° . Two compass points, or $22^\circ 30'$, is considered too small, or, at least, barely acceptable.

Sometimes a compass bearing of a single object on shore may be taken and combined with the horizontal angle at the vessel between that landmark and some other landmark which is shown upon the chart.

The best method, as already stated, because it entirely avoids compass errors, is that by two horizontal angles known among mariners as the "three point problem." For the purpose of observation there is needed a sextant, which, by the way, may be used by any one reasonably expert, even when a vessel is rolling and pitching heavily, or an alidade mounted upon a compass or otherwise mounted, and graduated to degrees, at least. By means of the sextant or the alidade, the horizontal angle, at the vessel, between two objects upon the land, known to be charted, is observed, and in connection therewith there is also observed at the same time a second angle at the vessel between one of these two landmarks and a third landmark also charted. By means of a metal or horn protractor, or a protractor printed upon tracing paper, these two angles may be transferred to the chart by so placing the sides of the angles that the several sides shall fall respectively upon the proper landmarks at the same time. The common apex of the angles is then the position of the ship for the time the angles were observed. This is the common method employed in surveying to determine the positions of the soundings which are to be placed upon the charts for the use of navigators. Habitual resort to this method will very much enhance the safety of the vessel.

Certain handy problems, in which the run of the vessel enters, are also employed to obtain the position of the ship from the observation of a single landmark. These are given and illustrated as follows:



In figure 1, a vessel proceeding on her way from A to B takes a bearing of the landmark L when it bears 4 points on the bow, that is to say, 4

NOTE.—This is demonstrated as follows: The angle LBA is a right angle, and the angle BAL an angle of 45° , each having been so taken. The angle BLA is, therefore, an angle of 45° , the triangle LBA isosceles, and the side LB equal to the side BA.

points or 45° from the course on which the vessel is steering. Without changing her course, the vessel notes at B, when the landmark comes exactly abeam, the distance run by the vessel from A to B. If there has been no current to give a wrong impression of the distance run, or to deviate the ship from the course steered, the distance LB, of the ship from the landmark, when the ship is at B and the landmark bears abeam, is equal to the distance AB made by the ship between the two bearings A and B respectively.

A check on the correctness of the position at B may be had by noting the distance run from B when the landmark is 4 points or 45° on the quarter; that is to say, when the vessel is at C. In this case, again, the distance run from B to C gives the distance of the vessel from the landmark when she was at B. This is known by sailors as the "bow-and-beam-bearing" method, and is regarded as a great convenience. It is not always possible to employ this method, however.

The following more general graphical construction may be used with bearings of a single object when the lines of bearing intersect conveniently.

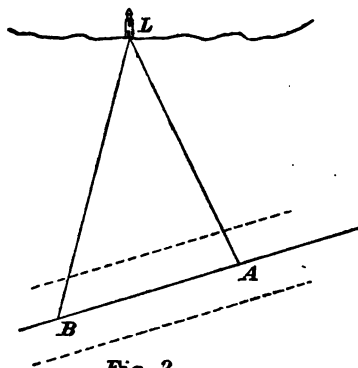


Fig. 2.

In figure 2, a vessel proceeds in the direction A to B without changing her course. At both A and B she takes a compass bearing of the landmark L, and at B notes the distance run on her course from A to B. A parallel ruler is set to the course AB by means of the compass rose on the chart, and the distance run from A to B is taken from the scale of the chart with a pair of dividers. The parallel rulers are then moved to and fro as shown by the dotted lines, and the dividers are applied to its edge until the parallel line AB is found, on which the intercepted distance AB is exactly spanned by the dividers as set by the scale. The line AB then represents upon the chart the course of the vessel, A, the point where she took her first bearing, and B the point where she took her second bearing.

THE COMPASS.

Points.	Number.	Degrees.			Number.	Points.
		°	'	"		
North.	0	0	0	0	0	South.
	$\frac{1}{8}$	1	24	22	$\frac{1}{8}$	
	$\frac{1}{4}$	2	48	45	$\frac{1}{4}$	
	$\frac{3}{8}$	4	18	7	$\frac{3}{8}$	
	$\frac{1}{2}$	5	37	30	$\frac{1}{2}$	
	$\frac{5}{8}$	7	1	52	$\frac{5}{8}$	
	$\frac{3}{4}$	8	26	15	$\frac{3}{4}$	
	$\frac{7}{8}$	9	50	37	$\frac{7}{8}$	
N. by E. N. by W.	1	11	15	0	1	S. by W. S. by E.
	$\frac{1}{8}$	12	39	22	$\frac{1}{8}$	
	$\frac{1}{4}$	14	3	45	$\frac{1}{4}$	
	$\frac{3}{8}$	15	28	7	$\frac{3}{8}$	
	$\frac{1}{2}$	16	52	30	$\frac{1}{2}$	
	$\frac{5}{8}$	18	16	52	$\frac{5}{8}$	
	$\frac{3}{4}$	19	41	15	$\frac{3}{4}$	
	$\frac{7}{8}$	21	5	37	$\frac{7}{8}$	
NNE NNW	2	22	30	0	2	SSW SSE.
	$\frac{1}{8}$	23	54	22	$\frac{1}{8}$	
	$\frac{1}{4}$	25	18	45	$\frac{1}{4}$	
	$\frac{3}{8}$	26	43	7	$\frac{3}{8}$	
	$\frac{1}{2}$	28	7	30	$\frac{1}{2}$	
	$\frac{5}{8}$	29	31	52	$\frac{5}{8}$	
	$\frac{3}{4}$	30	56	15	$\frac{3}{4}$	
	$\frac{7}{8}$	32	20	37	$\frac{7}{8}$	
NE. by N. NW. by N.	3	33	45	0	3	SW. by S. SE. by S.
	$\frac{1}{8}$	35	9	22	$\frac{1}{8}$	
	$\frac{1}{4}$	36	33	45	$\frac{1}{4}$	
	$\frac{3}{8}$	37	58	7	$\frac{3}{8}$	
	$\frac{1}{2}$	39	22	30	$\frac{1}{2}$	
	$\frac{5}{8}$	40	46	52	$\frac{5}{8}$	
	$\frac{3}{4}$	42	11	15	$\frac{3}{4}$	
	$\frac{7}{8}$	43	35	37	$\frac{7}{8}$	
NE NW	4	45	0	0	4	SW SE.
	$\frac{1}{8}$	46	24	22	$\frac{1}{8}$	
	$\frac{1}{4}$	47	48	45	$\frac{1}{4}$	
	$\frac{3}{8}$	49	13	7	$\frac{3}{8}$	
	$\frac{1}{2}$	50	37	30	$\frac{1}{2}$	
	$\frac{5}{8}$	52	1	52	$\frac{5}{8}$	
	$\frac{3}{4}$	53	26	15	$\frac{3}{4}$	
	$\frac{7}{8}$	54	50	37	$\frac{7}{8}$	

THE COMPASS—*Continued.*

Points.	Number.	Degrees.	Number.	Points.
NE. by E.....NW. by W....	5	56 15 0	5	SW. by W.....SE. by E.
	$\frac{1}{8}$	57 39 22	$\frac{1}{8}$	
	$\frac{1}{4}$	59 3 45	$\frac{1}{4}$	
	$\frac{3}{8}$	60 28 7	$\frac{3}{8}$	
	$\frac{1}{2}$	61 52 30	$\frac{1}{2}$	
	$\frac{5}{8}$	63 16 52	$\frac{5}{8}$	
	$\frac{3}{4}$	64 41 15	$\frac{3}{4}$	
	$\frac{7}{8}$	66 5 37	$\frac{7}{8}$	
ENE.....WNW....	6	67 30 0	6	WSW.....ESE.
	$\frac{1}{8}$	68 54 22	$\frac{1}{8}$	
	$\frac{1}{4}$	70 18 45	$\frac{1}{4}$	
	$\frac{3}{8}$	71 43 7	$\frac{3}{8}$	
	$\frac{1}{2}$	73 7 30	$\frac{1}{2}$	
	$\frac{5}{8}$	74 31 52	$\frac{5}{8}$	
	$\frac{3}{4}$	75 56 15	$\frac{3}{4}$	
	$\frac{7}{8}$	77 20 37	$\frac{7}{8}$	
E. by N.....W. by N....	7	78 45 0	7	W. by S.....E. by S.
	$\frac{1}{8}$	80 9 22	$\frac{1}{8}$	
	$\frac{1}{4}$	81 33 45	$\frac{1}{4}$	
	$\frac{3}{8}$	82 58 7	$\frac{3}{8}$	
	$\frac{1}{2}$	84 22 30	$\frac{1}{2}$	
	$\frac{5}{8}$	85 46 52	$\frac{5}{8}$	
	$\frac{3}{4}$	87 11 15	$\frac{3}{4}$	
	$\frac{7}{8}$	88 35 37	$\frac{7}{8}$	
East.....West....	8	90 0 0	8	West.....East.

TABLE FOR CONVERTING STATUTE MILES INTO SEA MILES.

1 statute mile = 5,280 feet.

1 sea mile or knot = 6,080 feet.

Statute miles.	Sea miles.	Statute miles.	Sea miles.	Statute miles.	Sea miles.
1.00	0.868	9.00	7.815	17.00	14.768
1.25	1.085	9.25	8.032	17.25	14.980
1.50	1.302	9.50	8.249	17.50	15.197
1.75	1.519	9.75	8.467	17.75	15.414
2.00	1.736	10.00	8.684	18.00	15.632
2.25	1.953	10.25	8.901	18.25	15.849
2.50	2.171	10.50	9.118	18.50	16.066
2.75	2.387	10.75	9.335	18.75	16.283
3.00	2.604	11.00	9.552	19.00	16.500
3.25	2.821	11.25	9.769	19.25	16.717
3.50	3.038	11.50	9.986	19.50	16.934
3.75	3.256	11.75	10.203	19.75	17.151
4.00	3.473	12.00	10.420	20.00	17.369
4.25	3.690	12.25	10.638	20.25	17.586
4.50	3.907	12.50	10.855	20.50	17.803
4.75	4.124	12.75	11.072	20.75	18.020
5.00	4.341	13.00	11.289	21.00	18.237
5.25	4.559	13.25	11.507	21.25	18.454
5.50	4.776	13.50	11.724	21.50	18.671
5.75	4.994	13.75	11.941	21.75	18.888
6.00	5.211	14.00	12.158	22.00	19.105
6.25	5.428	14.25	12.376	22.25	19.322
6.50	5.645	14.50	12.593	22.50	19.539
6.75	5.862	14.75	12.810	22.75	19.756
7.00	6.079	15.00	13.027	23.00	19.973
7.25	6.296	15.25	13.244	23.25	20.191
7.50	6.513	15.50	13.461	23.50	20.408
7.75	6.730	15.75	13.678	23.75	20.625
8.00	6.947	16.00	13.895	24.00	20.842
8.25	7.164	16.25	14.112	24.25	21.060
8.50	7.381	16.50	14.329	24.50	21.277
8.75	7.598	16.75	14.546	25.00	21.711
$\frac{1}{4}$	0.217	$\frac{1}{2}$	0.434	$\frac{3}{4}$	0.651

SEA MILES TO STATUTE MILES.

TABLE FOR CONVERTING SEA MILES INTO STATUTE MILES.

1 sea mile or knot = 6,080 feet.

1 statute mile = 5,280 feet.

Sea miles.	Statute miles.	Sea miles.	Statute miles.	Sea miles.	Statute miles.
1.00	1.151	8.75	10.075	16.50	18.999
1.25	1.439	9.00	10.363	16.75	19.287
1.50	1.729	9.25	10.651	17.00	19.575
1.75	2.015	9.50	10.939	17.25	19.863
2.00	2.303	9.75	11.227	17.50	20.151
2.25	2.590	10.00	11.515	17.75	20.439
2.50	2.878	10.25	11.803	18.00	20.727
2.75	3.166	10.50	12.090	18.25	21.015
3.00	3.454	10.75	12.378	18.50	21.303
3.25	3.742	11.00	12.666	18.75	21.590
3.50	4.030	11.25	12.954	19.00	21.878
3.75	4.318	11.50	13.242	19.25	22.166
4.00	4.606	11.75	13.530	19.50	22.454
4.25	4.893	12.00	13.818	19.75	22.742
4.50	5.181	12.25	14.106	20.00	23.030
4.75	5.469	12.50	14.393	20.25	23.318
5.00	5.757	12.75	14.681	20.50	23.606
5.25	6.045	13.00	14.969	20.75	23.893
5.50	6.333	13.25	15.257	21.00	24.181
5.75	6.621	13.50	15.545	21.25	24.468
6.00	6.909	13.75	15.833	21.50	24.757
6.25	7.196	14.00	16.121	21.75	25.045
6.50	7.484	14.25	16.409	22.00	25.333
6.75	7.772	14.50	16.696	22.25	25.621
7.00	8.060	14.75	16.984	22.50	25.909
7.25	8.348	15.00	17.272	22.75	26.196
7.50	8.636	15.25	17.560	23.00	26.484
7.75	8.924	15.50	17.848	23.50	27.000
8.00	9.212	15.75	18.136	24.00	27.636
8.25	9.500	16.00	18.424	24.50	28.212
8.50	9.787	16.25	18.712	25.00	28.787

DRAFT IN SALT AND FRESH WATER.

With regard to the amount a vessel will rise in passing from fresh to salt water, the following table shows approximately :

Moulded depth in feet.	Approximate amount of rise of a vessel passing from fresh to sea water.		
	Vessels without erections on deck.	Awning deck vessels.	Spar deck vessels.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
9 and under 11.....	2	-----	-----
11 and under 18.....	2½	-----	-----
18 and under 16.....	3	3½	4
16 and under 19.....	3½	4	4½
19 and under 22.....	4	4½	5
22 and under 25.....	4½	5	5½
25 and under 28.....	5	5½	6
28 and under 31.....	5½	6	6½
31 and under 34.....	6	6½	7

The weight of a cubic foot of salt water being taken to be 64 pounds; that of fresh water 62.5 pounds.

This table applies, as a general rule, for all except those of extremely full or extremely fine form.



INDEX.

A.		Page.		Page.	
Abbaye point.....	22	Black bay, shoal in entrance.....	32		
— shoal east of.....	3	Black river.....	32		
Agate bay, Minnesota.....	28	Blake point.....	35		
— fog signal.....	28	— shoal east of.....	4		
— light.....	28	Bochewauaug bay.....	34		
Agate harbor, Michigan.....	19	Bois Blanc island.....	63		
Agate point.....	19	— coast of.....	64		
Albany island.....	55	— life saving station.....	63		
Amygdaloid island.....	4	— light.....	63		
— rocks off.....	4	— shoal NW. of.....	63		
Anchorage, Lake Superior.....	35	Boot island.....	56		
Anchoring in deep water.....	79	Brule river.....	4		
Apostle islands.....	34	— rocks west of.....	4		
— anchorages.....	35	Brulée point.....	56		
Arthur, port.....	31	Brusants point.....	40		
Ashland.....	15	Burlington.....	28		
		Burlington bay.....	28		
B.		C.			
Baraga.....	22	Canadian storm signals.....	77		
Barbed point.....	52	Canoe rocks.....	4		
Bark bay.....	12	— shoal ENE. of.....	4		
— point.....	12	Caribou island.....	36		
Batteau rock.....	4	— fog signal.....	36		
— shoal east of.....	4	— light.....	36		
Battle island.....	32	— shoals off of.....	5		
— light.....	32	Carlton bay.....	55		
Bay City.....	2	Carp river.....	56		
Bayfield.....	13	Cat island.....	35		
— rock.....	40	— anchorage.....	35		
— rangellights.....	40	Catholic Mission, range lights.....	41		
— to Beaver City.....	14	Chaquamegon bay.....	14		
— to Ontonagon.....	13	— point.....	14		
— to Silver Islet landing.....	14	— fog signal.....	14		
Beaver Tail point.....	55	— light.....	14		
Bells point.....	48	Chappel rock.....	26		
Bete Grise bay.....	21	Charts, use of.....	83		
Biddle point.....	65	Cheboygan.....	59		
Big Bay point.....	23	— direction.....	59		
— spit north of.....	3	— fog signal.....	59		
Big Fork.....	30	— improvements.....	59		
Big point.....	48	— lights.....	58, 59		
Big Trout bay.....	30	— range lights.....	59		
Birch point.....	43	— river.....	59		
Black bay.....	32	— shoal.....	58		

	Page.		Page.
Cheboygan shoal, buoy.....	58	Duluth bay	6
—— to Detour passage.....	60	—— canal	6
—— to Presqu' Ile	59	—— caution	7
—— Michigan	59	—— Connors point range lights..	7
Chippewa harbor	35	—— fog signal.....	8
Church point.....	42	—— harbor	6
—— range lights.....	42	—— lights	7
Churchs point.....	42	—— North Channel east range	
Churchville point	42	lights	8
—— light.....	42	—— North Channel west range	
Clinton point.....	15	lights	8
Collier port	53	—— note	7
Compass points	91	—— Ohio dock light.....	7
Connors point.....	7	—— pilots	7
—— range lights.....	7	—— Rice point range lights.....	7
Copper harbor	20	—— South Channel range lights..	8
—— light.....	20	—— to Agate harbor	9
—— range lights.....	20	—— Apostle islands	9
Copper Mine point.....	34	—— Bayfield	8, 9
—— rocks near	5	—— Beaver bay	10
Crisps life saving station	27	—— Chaquamegon.....	9
Currents Lake Superior	81	—— dangers	2
D.		—— Copper harbor.....	9
Dark Hole passage.....	45	—— Detour station, dangers..	2
—— east range lights.....	45	—— Eagle harbor	9
—— west range lights.....	44	—— Eagle river	9
Detour passage	52	—— Ontonagon	9
—— eastern shore.....	53	—— Saint Marys river.....	8
—— western shore	52	—— Silver Islet landing.....	10
—— point.....	53, 55	—— Washington harbor	10
—— fog signal.....	47, 53	—— West	12
—— light.....	47, 53	Duncan bay	35, 59
—— to Cheboygan	54	E.	
—— to Duck Island light..	54	Eagle harbor.....	19
—— to Presqu' Ile light ..	54	—— light	19
—— to Waugoshance.....	55	—— range lights	19
—— post office.....	52	Eagle island	12
—— reef.....	53	—— river	18
—— buoy.....	53	—— dangers	2
—— shoal	53	—— river harbor	19
—— buoy.....	53	—— lights	19
Devils island.....	12, 34	East Huron island.....	22
—— fog signal.....	12	—— Moran bay	57
—— light.....	12	—— Neebish range lights	43
Distress signals	77	Edward island	32
Dix point.....	53	Encampment island	28
Dollar bay.....	18	—— shoal	4
Draft in salt and fresh water.....	95	—— light.....	46
Drummond island	53	F.	
Duck island	43, 54	Fair island	53
—— range lights	43	Farmers ridge passage	41
Duluth	6	—— range lights	40

	Page.		Page.
Fish creek	15	Grand island harbor	25
Five-foot shoal buoy	52	_____ buoys	25
Fond du Lac	12	_____ directions	25
Footes dock, light	39	_____ light	25
Fort Mackinac	64	_____ range lights	25
_____ Wilkins	20	_____ to Saint Marys river ..	26
_____ William	30	Grand Marais harbor, Michigan ..	26
Fourteen Mile point	16	_____ Minnesota	29
_____ fog signal	16	_____ fog signal	29
_____ light	16	_____ light	29
_____ spit off of	2	Grand Portage bay	4
_____ to Keweenaw point, dangers ..	2	_____ rocks and islands	4
Frechette point	50	_____ island	29
Freedom village	60	_____ Portal	26
Frying Pan island	53	Granite island	23
_____ light	47, 53	_____ fog signal	23
Fuyards point	56	_____ light	23
		_____ shoals near	4
G.		_____ islet	32
Gaffney point	52	_____ point	23, 28
_____ shoals SE. of	52	_____ rocks in line with	3
Garden River	48	Grassy point	12
_____ reach	42	Gratiot river	18
Gargantua cape	34	Gray reef	62
_____ harbor	33	_____ fog signal	62
_____ light	34	_____ light	62
Garlic point	23	Gros Cap	57
General information	83	_____ caution	4
_____ charts	83	Gross point	57
_____ distortion	85	Grosse Ile St. Martin	57
_____ of	85	Gull islands	35
_____ use of	84	_____ reefs south and west of ..	4
_____ fog signals	86	_____ rock	20
_____ light lists	83	_____ buoy	20
_____ notice to mari-	84	_____ light	20
_____ ners	84	_____ shoal south of	2
_____ sailing direc-	83		
_____ tions	83	H.	
_____ vessel's position	87	Hancock	18
George lake	42	Hare islet	30
_____ lights	42, 43	Harwood point	44
Gonlals bay	34	_____ buoy	44
Good Harbor bay	4	_____ range lights	44
Goose island	56	Hat point	29
_____ reef near	56	Hay lake	37
Gooseberry river	28	_____ channel	50
_____ reef off of	4, 29	_____ distance table	38
Grace harbor	3, 35	_____ range lights, pro-	51
Graham shoals	57	_____ posed	51
_____ buoys	57	Hen and chickens, range lights ..	44
_____ currents	57	Hermits island	9
Grand island	26	Hessel village	56
_____ light	26	Houghton	18

	Page.		Page.
Houghton point	14	Lake Huron	54
Huron bay	22	— Michigan	61
— east	22	— Superior	1
— islands	22	Lamb island	32
— fog signal	22	— light	32
— light	22	L'Anse town	22
— lake	54	La Pointe	13
— mountains	23	— anchorage	35
— river	22	— light	14
— point	23	— to Fourteen mile point,	
— shoal NE. of	3	dangers	2
Hydrographic office, agents of	113	Laughing fish point	3, 24
— publications,		— spit off of	3
list of	107	Leach island	5
I.		— rocks off of	5
Ile La Salle	56	Lewis point	40
— Marquette	56	Light, Agate bay	29
— St. Martin	56	— au Sable point	26
Indian point	43	— aux Pins point	39
— range lights	44	— Battle island	32
Iroquois point	27	— Bayfield, range	40
— fog signal	27	— Bois Blanc island	63
— light	27	— Caribou islands	36
Isabelle point	21	— Catholic mission range	41
— shoal water	3	— Chaquamegon bay	14
Isle aux Roches	4, 28	— Cheboygan	59
— Chapeau	35	— range	59
— Royale	35	— Church point, range	42
— light	35	— Churchillville point	42
— shoals in vicinity	3	— Connors point, range	7
J.		— Copper harbor	20
Jenkins rock, buoy	40	— range	20
Johnson point	45	— Corbay point	34
K.		— Dark Hole, range, east	45
Kaministiquia river	30	— west	44
— lights	31	— Detour point	47
Keweenaw bay	22	— Devils island	12
— point	17	— Duck island range	43
— shoal south of	3	— Duluth	7
Knife island	28	— Eagle harbor	19
— river	28	— range	19
Knob island	30	— River harbor	19
— light	30	— East Neebish, ranges	43
— rock SW. of	5	— Encampment	46
L.		— Farmers Ridge	40
Lac la Belle	21	— Footes dock	39
Lac Tracy	1	— Fourteen Mile point	16
Lake, (<i>See</i> proper name).		— Frying Pan island	47
— George	42	— Gargantua harbor	34
— lights	42, 43	— George lake	42, 43
		— Grand island	26
		— harbor	25
		— range	25

	Page.		Page.
Light, Grand Marais harbor.....	29	Light, Sailors Encampment, range,	
— Granite island.....	23	upper.....	46
— Gray reef.....	62	— St. Helena island.....	58
— Gull rock.....	20	— St. Marys Falls canal, range..	39
— Harwood point.....	44	river, ranges.....	39
— Hay Lake channel, ranges, pro-		— Sand island.....	12
posed.....	51	— Sand point.....	22
— Hen and chickens, range.....	44	— Sault range.....	40
— Huron island.....	22	— Sault Sainte Marie, range.....	40
— Indian point, range.....	44	— South channel, range.....	8
— Iroquois point.....	27	— Spectacle reef.....	63
— Isle Royale.....	35	— Stannards rock.....	23
— Kaministiquia river.....	31	— Sugar island, range.....	40
— Lake George, ranges.....	42, 43	— Superior bay, channel range..	11
— Lamb island.....	32	Quebec range.....	11
— La Pointe.....	14	range.....	11
— Mackinac point, old.....	60	City.....	10
— Manhattan shoal.....	42	— Sweets point.....	47
— Manitou island.....	20	— Thunder cape.....	30
— Marquette.....	24	— Topsail island, range.....	40
— McGulpin point.....	60	— Victoria island.....	29
— Menagerie island.....	35	— Washburn.....	14
— Michigan island.....	15	— Waugoshance.....	61
— Michipicoten island.....	36	— White shoal.....	62
— Neebish, range, east.....	43	— Whitefish point.....	27
— North Channel, range, east....	8	— William Rains wharf, range..	45
west.....	8	— Winter point, range.....	46
— Old Point Mackinac.....	60	Lilly pond.....	18
— Ontonagon.....	15	Lime island, dock.....	38
— Outer island.....	13	List of Hydrographic Office agents	113
— Palmers point, range.....	41	Hydrographic Office publica-	
— Partridge point, range.....	41	tions.....	107
— Passage island.....	35	Little fork.....	30
— Payment range.....	41	Iron river, spit off.....	3
— Peninsula harbor.....	33	Lake George.....	41
— Pipe island.....	47	Rapids.....	51
— Point au Sable.....	26	Lizard island.....	34
of Woods, range.....	45	rocks off.....	5
— Pointe aux Pins.....	39	Lookout point.....	53
— Poe reef.....	63	Lucille island.....	29
— Porphyry point.....	32		
— Port Arthur.....	31		
— Portage bay.....	17		
river.....	18		
range.....	18		
— Quebec channel.....	11		
harbor.....	36		
— Rains island, range.....	45		
wharf, range.....	45		
— Raspberry, island.....	13		
— Rice point, range.....	7		
— Round island.....	47		
— Sailors Encampment, range,			
lower.....	46		

M.

Mackinac City.....	60
fort.....	64
harbor.....	65
anchorage.....	65
buoy.....	65
current.....	65
island.....	64
point, old.....	60
fog signal.....	60
light.....	60
straits.....	54
south channel.....	62

	Page.		Page.
Mackinac, town.....	64	Minnesota point.....	6
—— directions	65	Mission point	65
—— pilots	65	Moffat harbor	32
—— tugs	65	Mondors	18
—— wharfage	65	Montreal island	34
Magdalene island	34	—— reef near	5
—— anchorage	35	—— rocks near	5
—— spit off of	2	—— river	15
Major shoal	64	Moran bay, east	57
—— buoy	64	—— west	57
Manhattan shoal	42	Mud lake	44
—— light	42	—— buoy	34
Manitou island	20, 35	Muskallonge life saving station....	27
—— fog signal	20		
—— light	20	N.	
—— rocky flat	2	Ned point	43
—— passage	16	Neebish, east, range lights	43
Marchand rock	40	—— island	44
—— buoy	40	—— range lights	43
Marquette	23	—— middle	50
—— bay	56	Nemadji river	10
—— fog signal	24	Newells wood wharf	52
—— island	56	Nine mile point	50
—— life saving station	24	Nipigon bay	32
—— lights	24	—— caution	32
—— lighthouse, rocks east of	3	—— region	29
—— to Grand island	24	—— river	32
—— St. Marys river	24	North channel	8
Martin reef	55	—— east, range lights	8
—— buoy	56	—— west, range lights	8
McCargoe cove	35	North Graham shoal	57
McGulpin point	60	—— buoy	57
—— light	60	—— harbor	20
McKay mount	30	—— Twin island	2
McLeod bay	58	—— spit off of	2
—— shoals in	58		
Menagerie island	35	O.	
—— light	35	Oak island	13
—— shoals ENE. of	4	—— point	2
Mendota	21	Ohio Central Coal Dock light	7
Michigan island	15	Oil, use of	78
—— light	15	Old Point Mackinac	60
—— shoals near	2	—— fog signal	60
—— lake	61	—— light	60
Michipicoten harbor	33	Ontonagon	15
—— island	36	—— lights	15
—— fog signal	36	—— river	15
—— light	36	—— to Agate harbor	15
—— shoals near	5	—— Beaver bay	16
—— river	33	—— Copper harbor	15
Middle ground (Superior bay)	11	—— Eagle harbor	15
—— island	23	—— Eagle river	15
—— Neebish	50	—— Manitou passage	16
		—— Marquette	16

	Page.		Page.
Ontonagon to Portage entry	16	Pipe island light	47, 53
—— Portage lake	15	Point, (<i>see</i> proper name)	
—— St. Marys river	16	Point aux Mines	5
—— Silver Islet landing ..	16	—— reef near	5
Ooawasee bay	50	Point au Sable	26, 60
Oronto bay	15	—— light	26
Oscar	18	—— spit off of	3
Otter head	33	—— aux Chênes	57
—— to Gargantua harbor ..	33	Point aux Frenes	50
—— Michipicoten harbor ..	33	Point Detour	55
—— Quebec harbor	33	—— to Cheboygan	54
—— St. Marys river	33	—— Duck island light ..	54
Outer island	13, 34	—— Lake Huron	54
—— anchorage	35	—— Waugoshance	55
—— fog signal	13	Point la Barbe	57
—— light	13	Point of Woods	45
—— shoals near	2	—— buoys	49
		—— range lights	45
P.		Pointe aux Pins, buoy	41
Palisades	29	—— light	39
Palmers point	41	Poe reef	63
—— buoy	41	—— fog signal	63
—— range lights	41	—— lightvessel	63
Pancake shoal	5, 34	Porcupine mountains	13
Paps, the	32	Porphyry point	32
Parisian island	34	—— light	32
—— rocks off	5	—— rocks westward of ..	5
Park point	6	Port Arthur	31
Partridge point	41	—— harbor master	31
—— range lights	41	—— light	31
Passage island	35	—— signal mast	31
—— caution	4	—— U. S. Representative ..	31
—— fog signal	35	—— Arthurs landing	31
—— light	35	—— Collier	53
Payment docks	42	Portage bay	29
—— range lights	41	—— entry	21
Peninsula harbor	33	—— flat in	3
Peninsula harbor, directions ..	33	—— to Grand Island har-	
—— light	33	bor	21
Pequaquawaming point	22	—— Manitou Island	
—— spit off of	3	—— passage	21
Pic island	36	—— Marquette	21
Pictured rocks	26	—— St. Marys river	21
Pie island	30	—— lake	17
—— rocks SE. of	5	—— canal	17
Pigeon bay	29	—— directions	17
—— point	29	—— fog signal	17
—— caution	4	—— life saving sta-	
—— river	29	tion	17
Pilgrim river	18	—— lights	17
Pine river	56	—— river	17, 21
Pine River bay	30	—— light	18
Pipe island	52	—— range lights	18

	Page.		Page.
Portal point.....	26	Sailors Encampment upper range	
Porters island.....	20	lights.....	46
Powells point.....	25	passage.....	46
Presqu' Ile.....	13	St. George island.....	49
Q.		St. Helena island.....	57
Quebec channel.....	10	buoy.....	58
light.....	10	caution.....	58
dock.....	10	light.....	58
harbor.....	36	harbor.....	58
fog signal.....	36	shoal.....	58
light.....	36	buoy.....	58
R.		St. Ignace.....	57
Rabbits Back peak.....	57	island.....	32
Rainbow cove.....	35	point.....	57
Rains island.....	44	St. Josephs island.....	37
range lights.....	45	St. Louis Bay.....	11
wharf.....	44	St. Louis river.....	6
range lights.....	45	current.....	6
Raspberry island.....	18	St. Martin bay.....	56
light.....	18	ile.....	56
Raynolds reef.....	63	point.....	56
buoy.....	63	St. Marys Falls canal.....	38
Red cliff.....	2, 13	range lights.....	39
Reed point.....	46	river.....	37
Rice point.....	7	Detour passage.....	51
range lights.....	7	directions, west to east.....	48
Riding out goes in deep water.....	79	distances by Hay	
Rock harbor.....	35	Lake channel.....	38
island.....	29	light and ranges.....	39, 47
caution.....	4	Sault Sainte Marie	
of Ages.....	10	(Canadian).....	37
Rocky island.....	35	Sault Sainte Marie	
Rocky island anchorage.....	35	(U. S.).....	37
shoal water.....	2	St. Tammany island.....	46
Rose shoal.....	61	St. Vital point.....	55
buoy.....	61	Salt point.....	27
Ross wharf.....	45	Salter island.....	32
Rossport.....	33	Sand island.....	12, 34
Rossport, directions.....	33	anchorage.....	35
Round island.....	39, 46, 64	light.....	12
range light.....	46	shoal water.....	2
shoal off.....	64	point.....	22
Rules for use of oil.....	78	light.....	22
Rules of the road.....	66-75	spit off of.....	3
S.		Sandy island.....	34
Saddlebag island.....	55	caution.....	5
Sail rock.....	26	point.....	22
Sailors Encampment island.....	44	Sault range lights.....	40
lower range		Sainte Marie.....	37
lights.....	46	canal.....	37
		range lights.....	40
		Scammon harbor.....	56
		Search bay.....	55

	Page.		Page.
Shelter bay	25	Superior city	10
Shot point	24	fog signal	10
shoal off	24	light	10
Signal stations	76	pilots	12
Silver island	31	routes	12
Simpson island	32	lake	1
Siskiwit bay	12, 35	anchorage	35
dangers in	3	Canadian shore	29
Six mile point	51	currents	81
shoal off	51	dangers, north shore	3
range	51	dangers, south shore	2
Slate island	36	dimensions	1
shoals off of	5	general remarks	5
South bay	25	harbors	6
channel, range lights	8	harbors of refuge	1
harbor	20	islands in	34
Graham shoal	57	islands, Canadian	36
buoy	57	islands, U. S.	34
Twin island	35	life saving stations	27
anchorage	35	navigation	1
shoal water	2	north shore	28
Spar island	30	south shore	12
Spectacle reef	62	anchorage	35
fog signal	63	storm signal stations	76
light	62	West	12
Squirrel island	37	Surveyors reef	55
Stannards rock	23	Swedeton creek	18
beacon	23	Sweets point	52
fog signal	23	buoy	52
light	23	light	47, 52
Steamboat island	12		
Stockton island	13, 35		
anchorage	35		
Storm signals	76		
Straits of Mackinac	54		
currents	57, 65		
directions	54		
islands in	62		
life, saving sta'n	63		
north shore	55		
shoals in	62		
south channel	62		
south shore	58		
Stribling point	44		
buoy	44		
Sucker river	27		
Sugar island	40		
range lights	40		
rapids	37		
Superior bay	11		
channel range lights	11		
Quebec range lights	11		
range lights	11		

T.

Tables sea miles to statute miles ..	94
statute miles to sea miles ..	93
Taquamenon island	27
river	27
Terrace point	29
The compass	91
Thompson island	30
Thunder bay	30
cape	30
fog signal	30
light	30
rocks SE. of	5
to Marquette	31
Whitefish point	31
Tobin harbor	35
reef	55
Todd harbor	35
Topsail island	40
range lights	40
Torch lake	17
Train bay	25

	Page.		Page.
Train island	25	Waugoshance shoals fog signal	61
——— shoal water	3	——— light	61
——— point	25	Wauswaugoning bay	4, 29
——— shoals off of	8	Weather signals	76
Traverse island	21	Welcome islands	30
——— shoal water	3	West channel	13
——— point	21	West Duluth	12
Trout bay	26	West Moran bay	57
——— point	26	West Superior	12
Two Heart river, life saving station ..	27	White shoal	62
Two Islands river	29	——— buoy	62
——— rocks off of	4	——— fog signal	62
U.		——— lightvessel	62
Union river	15	Whitefish bay	27
U. S. storm signals	76	——— point	27
V.		——— fog signal	27
Valley creek	22	——— light	27
Vermillion point	27	William Rains wharf	45
——— life saving station ..	27	——— range lights ..	45
Victoria island	30	Williams island	25
——— light	31	——— dangers near	3
——— rock SW. of	5	——— landing	25
Vidal shoal	48	——— shoal	25
Vienna shoal	61	——— buoy	25
——— buoy	61	Winter point	46
W.		——— range lights	46
Washburn	14	Wisconsin point	6
——— private lights	14	Wood island	25
Washington harbor	3, 35	——— shoal water	3
——— island	3	Wright island	35
——— rocky shoals	3	Y.	
Waugoshance island	61	York island	13
——— point	61	——— sand spit off of	2
——— 16-foot shoal	61	Z.	
——— buoy	61	Zela point	64
——— shoals	61	——— shoal	64
——— caution	61	——— buoy	64

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